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DEATH OF SAMUEL P. PARHAM.—Samuel P. Parham, late Chief Engineer of the Mutual gas company, and formerly Engineer of the Metropolitan gas company, died suddenly of paralysis at his residence in Philadelphia, on Nov. 26th, in the fifty-sixth year of his age.

THE MAXIM ELECTRIC LAMP.

During the past month the attention of the public, and more particularly of investors, has been called to the Maxim Light, as exhibited by the United States Electric Light Company in the Safe Deposit Vaults under the Equitable Building. The good taste and good sense displayed in this exhibition are worthy of commendation. The rooms are elegant in all their appointments, being evidently arranged under the highest advantages of the decorator's art. In the "reading room" are a handsome chandelier with 5 lights and four brackets with two lights each. The lamps themselves are screened from view by very ornate shades, of the latest pattern, such as are used with gas. In the vaults below are about fifty lamps mostly without shades. Upon each of the arms which support the lamps is a stop cock "to turn the light up or down;" but by this expression is meant to light or extinguish the lamp. All wires, etc., are ought of sight, within the fixtures, and every thing looks very beautiful. The reading room is perhaps 20 feet square, and with its 13 electric lights is about as well lighted as it would be with four good five foot burners burning the average twenty-candle gas which is made in New York city. The light is quite steady although, upon close examination of the unshaded lamp, pulsations corresponding to the movement of the engine can be easily detected.

The lamps themselves are very similar in appearance to the Edison incandescent lamp, but the carbon filament which is heated to incandescence by the current is arranged in the form of a letter M, instead of the horseshoe, as in Edison's; and this is made by depositing upon a strip of paper carbon a metallic layer of graphitic carbon by heating the original strip with a current in an atmosphere of gasoline vapor. This covering is the same substance as is kown to the gas maker as retort carbon, and is practically deposited in the same way as retort carbon is formed in gas retorts. As all gas makers know, this is a hard, strong, substance, and well calculated to sustain a high degree of heat.

Prof. Henry Morton, President of Stevens Institute, Hoboken, has tested some of these lamps, and gives the results of his tests in the *Sanitary Engineer*, of Dec. 1st, 1880, as follows:

"I have measured a number of these lamps with such results as the folowing:

"Lamp A. Resistance cold 20.4 ohms. and when yielding in its best position the light of 50 standard candles its resistance was 8.3 ohms. The current required to heat it to this degree was one of 4.07 webers, and the energy expended was therefore about 5,850 pounds. This would represent about five and a-half (5½) such lamps to each horse power of energy of current employed or an efficiency of about 275 candles per horse power. Taking 70 per cent. of this as the average for all positions we would have about 192 candles per horse power of current. Now the amount of actual horse power in the steam engine required to develop one horse power in the lamps will vary with the dynamo-electric machine, the number of lamps in use, and many other conditions, but we may assume 60 per cent. as a safe allowance and this would give us about 115 candles per actual horse power from the engine as the efficiency of this lamp when run at 50 candles.

Another lamp (D) whose resistance cold was 115 ohms. when yielding a light of 52 candles required a current of 1.35 webers and had a resistance of 64 ohms. when emitting the above mentioned amount of light.

"The electric energy consumed in this case was therefore about 5,131 foot pounds per minute or about 6.4 such lamps to a horse power, or at a rate of 330 candles per horse power of current.

"Taking 70 per cent. as the average light in all directions, reduces this to 231 candles, and assuming 60 per cent. as the efficiency of the conversion from steam power into electric current in the lamp, brings it to 138 candles per horse power of mechanical force developed in the steam engine."

In the same article, speaking of Edison's lamp, as most recently improved, the following is given as its efficiency:

"In a certain variety of bamboo he has found something which he believes will yield him a fine hair-like thread of carbon with which he can obtain the light of 16 candles from a single lamp, at an expense of 3,400 foot-pounds of energy a minute. This would represent about 9 such lamps, or about 155 candles per horse power."

In comparing these two results it should be borne in mind that in the case of Edison the light was of 16 candle power, and in the case of Maxim

50 candle power. The lamps used in the Safe Deposit rooms do not exceed 14 or 15 candles each. The experiments were doubtless made under very favorable conditions, and if we were to state the results obtained practically in round numbers, we should place the amount of light obtained at 100 candles per horse power per hour.

Taking this as a convenient basis, every manager can estimate for himself how many horse power it would take to furnish equivalent light for his district with the incandescent light. Bearing in mind that the plant required must be large enough to meet the requirements of the hour of largest consumption, for the current cannot be stored, and that a certain amount of duplicate plant must be necessary, it will be exceedingly difficult to demonstrate any *economy* in electric lighting leaving all other questions out of the case.

Business Ways of Doing Business.

There are many symptoms that are most decidedly favorable in the conduct of the gas business at the present time. It is with much pleasure that we hear of any efforts on the part of gas companies to place themselves on the same basis with their customers as the managers of other branches of business are very particular to do. The good will of any community is worth as much as capital in some kinds of business, and as most gas companies have full as much capital as they need, there is no better investment for them than the good will of the communities they serve. The time for quietly sitting still and taking whatever business happens to come along is past. High prices and higher dividends must face cheap oil as a competitor, and in the long run, under these conditions, the oil will have the advantage. How to meet this competition successfully is a serious problem with many companies, and it is with pleasure that we are able to give the following example of how it is being done in the thriving community of Worcester, Mass. :

NOTICE TO GAS CONSUMERS.

November 11th, 1880.

On and after this date the price of gas will be reduced to $2.25 per thousand cubic feet for all bills paid to collectors, or at this office before the 15th of the month ; all bills not paid on or before the 15th will be subject to an extra charge of 50 cents per thousand cubic feet.

It is for the interest of the consumer as well as the gas company that all bills be paid promptly. As this is the lowert price at which gas has ever been sold in Worcester, and lower than in any other place in Massachusetts, all things taken into consideration, we hope for a more extended use of it.

Should you not be a user of gas, we hope you will enter your name, as such, at an early day.

Call at our office and we will satisfy you that gas is the best and cheapest to use for an artificial light. With proper burners and economy in its use, no one can complain of the expense of using gas, the safest, cleanest and most convenient of all artificial illuminants.

Nothing is of more importance than to burn gas properly, if you would obtain the best results at the least expense. Many complaints, and most of the dissatisfaction from the use of gas, arise from some mismanagement for which the gas or gas company should not be blamed. We find, by long experience, that defective gas piping inside the building causes many complaints of poor gas, but poor burners and shades may, and often do, spoil the effect of the best gas made, and reduce the illuminating power of the gas from one half to three-fourths its proper results, and the gas or gas company get the blame.

Call at the office and let us know of any trouble with the quantity or quality and we will endeavor to make all right and every consumer satisfied.

We keep a few cheap but good burners on hand, which we sell at cost, also samples of those more expensive. We will furnish and put on any burner or shade in the market at cost. Great improvements have been made in burners, shades, and shade holders, and an increase of light from ten to sixty per cent. can often be obtained by a small expense in making the necessary and proper change.

Set your kerosene lamps one side and try gas for one month, and you will never return to the use of the dangerous, troublesome, dirty, and inefficient light again, when gas can be obtained at $2.25 per thousand cubic feet.

Trusting you will help us in our efforts to obtain a good, safe, and clean light, at a low price, by an extended use of gas,

We are respectfully yours,
THE WORCESTER GAS LIGHT CO.,
J. H. ROLLINS, *Agt. & Supt.*

In other places we have no doubt that similar efforts are being made, and we feel sure that only good results will follow. The consumer should be made to understand that his interest and that of the company are mutual, and there is no reason why any reasonable complaint should not be as freely made and remedy as easily obtained in the dealings with a gas company as in dealings with any other party who supplies what is required for daily use.

When difficulties are to be met the company should be ready to promptly attend to them, and, as an example of good practice in this direction, we give the following from a company in Canada—

CONSUMERS GAS COMPANY,
TORONTO, October 19th 1880.

Should you observe any defect in your gas you are requested to inform the company immediately. If any defect exists, it is caused either by some stoppage in the pipes, or from the burners used not being suitable for the gas now supplied, which is of heavier gravity than coal gas, and not from the want of illuminating power, which from numerous tests made by the government inspector, and tests made several times daily by the company, is shown to be considerably higher than that of the coal gas previously supplied. *Wherever this gas has been supplied lava-tipped burners have not answered.*

On notification being given at the company's office, 19 Toronto street, your pipes and burners will be examined, and if found necessary, new burners will be substituted free of charge.

W. H. PEARSON;
Secretary.

Above all things it should be borne in mind that the good will of the community to be supplied is the most valuable adjunct to any business, and that manager who secures it most completely will be the most successful.

Van Nostrand's Engineering Magazine.

"The publication of *Van Nostrand's Engineering Magazine* has never been a source of pecuniary profit to the publisher. The fact implied by its title, that it is designed exclusively for the engineering profession is not calculated to invite the aid or even the attention of those who are not engineers.

"The success of the magazine has been so far short of that which the plan seemed to merit, that the publisher has felt strongly inclined to discontinue it. The urgent protests, however, against such a step encourage the belief that such aid as friends can afford, in the way of securing one additional subscriber in their own neighborhood, would so far increase the demand as to fully justify the continued publication of the magazine.

"The publisher therefore ventures to solicit such assistance of this kind as the friends of the magazine can conveniently give."

We regret that a statement like this is possible in this country at the present time, and most sincerely hope that every one interested in the advancement of Engineering Science will do something to promote the future success of so able and conscientious a magazine.

Deliberate Suicide by the New Method.

About 8 o'clock on Wednesdaay night a man of twenty registered at the Summit Hotel, Bowery and Canal Street, as Fred. Brege, and paid for a night's lodging. He was assigned to room 49, on the fourth floor. Yesterday afternoon he was found dead in bed, with the room full of gas. He had taken the burner out of the bracket, in order that the gas might escape more freely, and securely fastened the window and fanlight, and had stuffed paper and clothing into the stovepipe hole and the keyhole to prevent the escape of the gas from the room. In his pockets were found $1.60 and a pawn ticket for a watch.—*N. Y. World*, Nov. 19.

SIPHONS IN SEWERS.—In constructing sewers it is often necessary to lead them across the branch of a river or some other water course. The passage has usually been accomplished on the plan of M. Belgrand, by means of a submerged siphon. The sunken portion, however, often clogs, and even where Belgrand's cleansing sphere is introduced the visits and repairs are difficult and costly. Maurice Leévy has introduced an elevated siphon, to carry the sewer waters from Bercy over the St. Martin canal. Water pipes and valves are connected with the summit of the siphon in such a way as to act automatically whenever the movement of the sewage becomes sluggish, and the experiment has proved satisfactory and economical.—*Ann. des Ponts et Chauss.*

HEATS OF COMBUSTION.—Herr Thomsen has published in the proceedings of the Berlin Chemical Society the results of his experiments upon the heat of combustion of carbonated gases and of cyanic compounds. These publications are posterior to those which were made by Berthelot, and they confirm in a remarkable manner the results which were obtained by the French chemist. They are specially important in consequence of their having removed the last traces of the error which had been made in estimating the heat of formation of ammonia, and, consequently, of all other bodies which are associated with it.—*Comptes Rendus.*

[Official Report.—Continued from page 228.]

Eighth Annual Meeting of the American Gas Light Association.

Held at Chicago, Ill., October 13, 14, and 15, 1880.

Morning Session—Oct. 14.

The President—Mr. George G. Ramsdell, of Vincennes, Ind., has a paper on Gas Engines, which we should now like to hear.

Mr. Ramsdell then read a paper entitled

GAS ENGINES.

Mr. President and Members of the Association:—I take it for granted that a description of the construction or principles of the gas engine is unnecessary at this time, and therefore have not prepared one; and presuming I was invited to prepare a paper on this subject that my experience, more especially with the large engine in use in our city, might be obtained, I shall to a great extent confine myself to that.

If I am somewhat enthusiastic on this subject, I am satisfied I am no more so than any member of the gas fraternity would be with a like experience, and no more than is, under the circumstances, justifiable.

I have prepared this paper with a sincere desire that it may contain just the information needed by any gas manager to enable him, in a business-like way, to successfully advocate the merits of these engines, and thereby secure their extensive use; and I have devoted much time and study to secure a fair and just comparison of its merits with those of the steam engine. I also earnestly desire to remove any prejudice, and to draw your attention to facts as they are proved by every-day experience, and not theoretically. I wish to prove to you that not only are small engines, of 2, 4, and 7 horse power, economical, but also engines of greater power, and in the same ratio.

I think you will agree with me that the idea has prevailed to a large extent that, while gas engines were used successfully abroad, their general use in this country, where the price of gas generally rules higher, was impracticable. But is it not also true that where there is a difference in the price of gas, a similar difference in prices of other articles, and especially those that enter into the use of steam, exists? My attention was strikingly called to this fact by the article in the American Gas Light Journal of Sept. 16, 1880, by Mr. F. T. Linton, and read before the North British Association of Gas Managers. By comparing his figures with those I shall lay before you in this paper, you will see that there is just about the same difference in the expense for steam as there is in the expense for gas.

There are two gas engines in operation in our city, and I have prepared figures in each case which I hope will prove of interest to you.

The purchase of the 17-horse power gas engine, which is of the Otto silent type, was somewhat in the nature of an experiment, as no gas engine larger than 7-horse power had ever been used in this country, and as no gas engine had been used, at least on so extensive a scale for the same purposes—it being used in an extensive grain elevator. For these reasons it was almost impossible to obtain reliable data as to the economy or adaptation of this class of engines to the work required to be performed, or any positive guarantee from the manufacturers, except that the engine should be as represented, and exert 17 indicated horse power. However, after much discussion and deliberation it was decided to try it, and I was instructed to procure the engine.

This was done through the Philadelphia agents, who cabled to Germany for it, and in due course of time it was received and erected ready for use.

The engine proved to be of the very finest workmanship and finish, equal to the best locomotive or tool work of this country, differing in general but slightly from the engines manufactured at Philadelphia. The engine is so constructed as to be perfectly automatic, regulating and making its speed perfectly uniform, supplying with oil its various working parts, making it absolutely unnecessary for any attendance except a general supervision such as any ordinary employee can perform. After being started it is left to take care of itself, and does so far better than an engineer could do, thus effecting one of its greatest economies—the saving of an engineer's wages. Any employee of ordinary intelligence can do all that is required for its successful operation, occupying but a few minutes each day, and scarcely interfering with his regular duties.

When men seek for a motive power, economy in first cost and subsequent maintenance become the principal considerations.

While all who have seen the large engine in operation have admired it, two-thirds of them have been skeptical as to the result of a few gas bills; but I am happy to say to you all that both of the engines in use to-day in the city of Vincennes are, to their owners, who pay the gas bills, more than satisfactory in this as well as every other respect.

Experience has shown positively that the question of economy is no longer in doubt, but is satisfactorily known.

Indeed, in the case of the 17-horse power engine, after four months' constant use, running 16 hours per day part of the time, and covering the busiest season of the year, economy is its chief characteristic.

Therefore, in enumerating the superior advantages of gas engines over steam engines, I would say that they are cheaper in first cost and in subsequent use, and I think I can show to your entire satisfaction that such is the case.

As to the first cost, I find that many persons consider the price, especially of the smaller sizes of these engines, excessive; but upon careful and intelligent comparison, I doubt if any fair-minded person would hesitate to say that a first-class steam engine of equal capacity and durability, with its necessary attachments, is as expensive in first cost, while in a years' use the gas engine is incomparably cheaper; and I think I can prove this by a case in our own city, by figures which are actual, and taken from experience with the two engines.

The proprietor of the *Daily Sun*, of our city, purchased a small Baxter improved upright steam engine and boiler, listed at $150, but for which he paid $125. After four months' use, and an outlay of over $40 for repairs, he was forced to set it aside as useless.

He then purchased an upright gas engine of equal horse power, for which he paid $425, and I submit the following comparison of cost.

I stated that his repairs in four months amounted to a little over $40; but considering this unusual and excessive, I have calculated the expense for repairs on engine and boiler at $75 per year, and although the engine virtually failed in four months, I have allowed it a life time of good working qualities of five years, and I think these estimates are probably fair. The showing would then be about as follows:

Steam Engine.

Engine and boiler	$125 00
Repairs, $75 per year, 5 years	375 00
Attendance, $182 per year; for 5 years	910 00
Coal, 1¼ bush. daily, $41.85 per year; for 5 years	209 25
Kindling, 4 cents daily, $16.48 per year; for 5 years	82 40
Oil, 12 gal. at 80 cents, $9.60; for 5 years	48 00
Extra insurance, $15; for 5 years	75 00
Total cost in 5 years	$1,824 65

Gas Engine.

Cost of engine	$425 00
Repairs, $15 per year; for 5 years	75 00
Gas, $22.50 per year; for 5 years	112 50
Oil as above, for 5 years	48 00
Total cost of engine in 5 years	$660 50
Total cost of engine, 5 years	$660 50
Less value of engine, depreciation 33⅓ per cent.	283 34
Net cost of gas engine, 5 years	$377 16

Recapitulation.

Cost of steam engine and boiler, 5 years	$1,824 65
Cost of gas engine, 5 years	377 16
Balance in favor of gas engine	$1,447 49
Deducting cost of engine—	
Net cost of operating steam engine 1 year	$339 93
Net cost of operating gas engine 1 year	47 10
Balance	$292 83
Cost of operating steam engine 1 day	$1 08 189-313
Cost of operating gas engine 1 day	15 15-313
Balance	$0 83 174-313

If any are skeptical, and consider my figures upon any item excessive, please observe that what was paid for a boy engineer exceeded by $532.84 the entire cost of the gas engine for the 5 years. Besides, there is ample room for varying the figures given to suit the prices ruling at any locality.

You will also notice that I have estimated the repairs on the gas engine at $15 per year; but the fact is, the engine has been in operation daily, except Sundays, for 22 months, and not one cent has been expended for repairs. Bear in mind also that in each case the same conditions prevailed. The gas engine was set in the same place the steam engine occupied, run the same machinery, and was operated by the same persons.

But it may be said that this is an extreme comparison—a good gas engine with a poor steam engine. Very good; let us see how it would show by taking a steam engine of equal durability—calculating repairs on gas engine one-third of repairs on steam engine and boiler, other conditions re-

maining unaltered. The life of each engine would now be fifteen years, and the comparison be as follows :

Steam Engine.

Cost of engine and boiler	$425 00
Repairs on engine and boiler, $45 per year ; for 15 years.	675 00
Attendance, $182 per year ; for 15 years	2,730 00
Coal, $41.85 per year ; for 15 years	627 75
Kindling, $16.48 per year ; for 15 years	247 20
Extra insurance, $15 per year ; for 15 years	225 00
Oil, 12 gallons, at 80 cts., per year, $9.60 ; for 15 years	144 00
Total cost of steam engine for 15 years	$5,073 95

Gas Engine.

Cost of engine	$425 00
Repairs, $15 per year ; for 15 years	225 00
Oil, as above, $9.60 per year ; for 15 years	144 00
Gas, 9 M, $22.50 per year ; for 15 years	337 50
Total cost of gas engine for 15 years	$1,131 50

Recapitulation.

Total cost of steam engine for 15 years	$5,073 95
Total cost of gas engine for 15 years	1,131 50
Balance in favor of gas engine	$3,942 45
Deducting cost of plant—	
Net cost of operating steam engine 1 year	$309 93
Net cost of operating gas engine 1 year	47 10
Balance in favor of gas engine	$262 83
Net cost of operating steam engine 1 day	$0 99 6-313
Net cost of operating gas engine 1 day	0 15 15-313
Balance in favor of gas engine	$0 83 304-313

The cost of the same power performed by hand labor was $2.50 per week, costing in the same time $1,950, or $818.50 more than the entire cost of the gas engine and expense of operating.

Now it seems to me that this one engine affords ample illustration to satisfy the most skeptical ; but I wish also to lay before you a comparison of the large gas engine, as used by the Elevator Company, and I think you will agree with me that it affords a still stronger endorsement.

In this, as well as in the former case, I have endeavored to be as accurate, fair, and impartial as possible, using, where it was necessary to estimate, my own judgment together with that of others whose knowledge renders their opinions trustworthy, and taking actual figures in the case of the gas engine.

In my comparison I consider the engines of equal workmanship and durability, and as filling the same place and operating the same machinery, doing the entire work of the elevator during the ten hours of each working day in the year.

Steam Engine.

Cost of 25-horse power steam engine (Corliss)	$1,320 00
25-horse power steam boiler	615 00
Chimney and britching	95 00
Furnace front, grates, etc	80 00
Building for same	475 00
Engineer, $60 per month, $720 per year ; for 25 years	18,000 00
Repairs on engine, $40 per year ; for 25 years	1,000 00
Repairs on boiler, $75 per year ; for 25 years	1,875 00
Repairs on furnace, etc., $25 per year ; for 25 years	625 00
Replacing boiler 1½ times	922 00
Erecting engine and boiler, etc	365 00
Coal, 28 bush. daily, 8,764 per year, at 9 cts. ; 25 years.	19,719 00
Kindling, one-tenth above	1,971 90
Water, $91 per year ; for 25 years	2,275 00
Oil, 56 gals,, at 80 cts., $44.80 per year ; for 25 years	1,120 00
Extra insurance, $160 per year ; for 25 years	4,000,00
Total cost of steam engine for 25 years	$54,457 90

Gas Engine.

Cost of 17-horse power gas engine	$1,385 00
Erecting same	165 00
Repairs, $40 per year ; for 25 years	1,000 00
Oil as before, for 25 years	1,120 00
Gas, 255,000 cu. ft., $511.80 per year ; for 25 years	12,795 00
Total cost of gas engine for 25 years.	$16,465 00

Recapitulation.

Total cost of steam engine for 25 years	$54,457 90
Total cost of gas engine for 25 years.	16,465 00
Balance in favor of gas engine	$37,992 90
Deducting cost of plant—	
Net cost of operating steam engine 1 year	$2,093 91 3-5
Net cost of operating gas engine 1 year	603 20
Balance in favor of gas engine	$1,490 71 3-5
Net cost of operating steam engine 1 day	$6 68 307-313
Net cost of operating gas engine 1 day	1 92 224-313
Balance in favor of gas engine	$4 76 83-313

You will notice that in my comparison I have taken a 25-horse power steam engine as against the 17-horse power gas engine, and for this reason : gas engines are so constructed that they will instantly and at any time give out their full actual power, while a steam engine depends entirely upon the boiler for its development of power, and as the generation of steam is in practical use more or less irregular, it follows that it would not be desirable to adopt a steam engine of just the power required. Thus, in the case before us, had they not purchased the 17-horse power gas engine they would have bought an engine and boiler of 25 horse power.

I have estimated the durability of the engines as equal, and the durability of the boiler at 10 years. In my estimate of fuel I have taken the amount of bituminous coal necessary to supply the Corliss, probably as economical as any steam engine in use to-day. It is also the rule laid down by Professor Rankin in his treatise on the "Steam Engine.

As to the price of coal, I of course take the price governing it where I live, and where the engine is operated. I have made no charge for water in the case of the gas engine, it having pumped the small quantity of water it used with the gas consumed, and charged to that account.

I feel assured that you will, upon investigating them, find that the figures are fair and just, and it would seem from them that in economy of first cost, in maintenance or expense of operating, the gas engine has very decided advantages over steam, and as this, I might say, is the vital point in the case, it must be my excuse for dwelling thus largely upon it.

Another important economy is that of space—occupying less space than a steam engine of equal power, while the latter requires the additional space necessary for the boiler, pumps, furnace, chimney, coal storage, etc.

Where the power is located in business houses and other places where space is limited, this becomes an important feature.

There is a great economy in wear and tear, or durability, which is owing to superior workmanship and the fact that all its working parts are lubricated perfectly by simple but effective automatic mechanism.

In the convenience and ease with which it is managed there is absolutely no comparison. In the case of the *Sun* office steam engine, the "devil" himself couldn't run it, and actually gave up his job through fear of an explosion. He now starts the gas engine, and goes to his work leaving the engine to care for itself until the presswork is accomplished, when he stops it.

Another thing I would mention is the economy of gas. Its very sensitive governor adjusts to a nicety the supply of gas to suit the load ploced upon it, so that the strictest economy ensues. The maximum of gas consumed per hour per horse power of work, as guaranteed by the manufacturers, is 21½ cubic feet.

In the case of the 17-horse power engine, the most it has ever consumed was while shelling corn, under a very heavy feed, while testing its power, when the consumption was at the rate of 305 cubic feet per hour, and as this was about the full power of the engine, it would show that its maximum was about 18 cubic feet instead of 21½ per hour.

You can scarcely have an adequate idea of the perfect adaptability of this motive power for grain elevators—combining entire freedom from danger of fire or explosion, and, as shown, a great economy over steam.

I have prepared a statement from the Elevator Company's books of the amount of grain handled by the engine during the four months of April, May, June, and July, and having made accurate tests of the gas consumed to perform the different classes of work, I can give you the exact figures :

18,016 bushels of corn shelled, at .18 cts	$32 45
10,555 bushels of grain drawn up an incline from the river, at .25 cts	26 38
15,577 bushels of grain fanned and dried, at .22 cts	34 27
110,720 bushels of grain elevated and loaded into cars, at .07 cts	77 50
154,867 bushels of grain, at a total expense of	$170 60

This would be an average expense of $42.65 per month—less by one-third than an engineer's wages, to say nothing of fuel, wear and tear, and danger from fire, etc.

They have been able to start the engine in a few seconds, day or night, and are more than satisfied with the results accomplished.

I am convinced that the gas engine will take the place of any medium sized engine operated by steam, perform the work more satisfactorily and at a reduced cost; especially is this true where the work performed is intermittent. There are very many of the reasons why gas is the chief of all means of artificial light that apply in the same manner to the gas engine—its constant readiness for use being a very prominent one, instead of the slow process of heating a large body of water; a turn of the wheel and the gas engine is ready to give out its full power.

After a careful study of this subject, I fail to bring to mind a single argument in favor of the steam engine that will stand the test of accurate and impartial comparison. In grain elevators, printing offices, workshops, stores, residenses, etc., their instant and constant readiness for work, and their perfect safety, which leaves insurance unaffected under gas engines—the cheapest, most convenient and desirable of any motor known.

Not long since two prominent architects from two of our larger cities visited our city for the purpose of investigating the merits of the gas engine for elevators in ordinary business houses. After they had departed I sat down and wrote to twelve parties who were using gas engines for the purpose of passenger and freight elevators, inquiring as to their satisfaction, expense of running, etc. I received a reply from each one, in every case expressing complete satisfaction, and strongly recommending the engines for the purpose used—two of them mentioning the fact that in over a year's use they had paid nothing for repairs. Thinking the figures in this branch of work might prove of interest, I have placed them in this paper.

Of the twelve replies, nine were in such a shape that the data could be used; the other three spoke only in general terms as to expense. Therefore I give you the results of nine gas engines in use at the present time for passenger and freight elevators, and hoists:

Total number of engines	9
Total horse power	32
Total number of hours used per day	83
Total number of hours used per month	2,158
Total cost of gas per day	$5.27
Total cost of gas per month	$137.25
Average number of hours per engine per day	9.15
Average number of hours per engine per month	240
Average cost per hour per engine	$0.063
Average cost per day per engine	$0.585
Average cost per month per engine	$15.25
Average cost per hour per horse power	$0.0178
Average cost per day per horse power	$0.165
Average cost per month per horse power	$4.29

Add to this small expense the advantages of complete safety, unaffected insurance, economy of space, entire freedom from coal dirt, ashes, kindling, etc., together with the fact that the porter in the store can do all that needs to be done, and that, too, in a few minutes' time each day, thereby saving an engineer's wages, and scarcely interfering with his own duties; and it does seem to me that you have the completest, cheapest, and most desirable motive power in use to-day.

The gas engine is a comparatively new invention, and has only entered into a very few branches of industry; but there are new fields developing every day, especially in our large cities, that require just such a power as the gas engine, and with such figures as these, taken from actual every day experience, it will require but small effort to convince any fair-minded man who stands in need of such power, of its merits. All that is needed is knowledge on the subject, and the rapid introduction of these engines is assured.

The importance of this to the gas interests of the country is very great, especially when it is taken into consideration that nine-tenths of the gas consumed would be in the daytime, when our mains are comparatively idle.

In conclusion, I would say that those who are provided with motive power will in all probability retain the power they now have, although I have shown that a gas engine would be a good investment; but those contemplating the purchase of power, especially for light and intermittent work, can be influenced, and it is with this point in view that I have attempted to prepare this paper, and to embody in it such comparisons and information as can be taken and shown with convincing force to such consumers, resulting in an extensive introduction of these valuable engines.

Applause followed the reading of the paper.

The Secretary—I move that a vote of thanks be tendered to Mr. Ramsdell for his very interesting paper. (Carried.)

Mr. Cartwright, of Philadelphia—I would suggest that Mr. Ramsdell embody in his paper the price of the gas. That will enable comparisons to be made in other places.

Mr. Ramsdell—I did not read it, but it is there. The price is $2.00 per thousand.

Mr. H. Cartwright—The consideration of figures is something which enters into the employment of gas engines in different localities. I am, for one, very much gratified at the economical results Mr. Ramsdell has arrived at by the comparisons that he has made. They are made with such care and thought that they ought to be considered thoroughly reliable.

Mr. Ramsdell—I wish to say a word in reference to the price charged for gas. The price of our gas is $2.50 per thousand feet, but we had the idea that the machine was going to be an enormous consumer, and we reduced the price to $2.00 per thousand; but I have since become convinced that that was a mistake. I learn that there is one gentlemen here who sold a gas engine. It is only a two-horse power machine. As an inducement, he gave the purchaser $100 worth of gas, which, according to my figures, ought to run it a year or two. I think it is a mistake to reduce the price of gas at all below the regular price. I think that, considering the economy in the use of the engine, those who have it can well afford to pay the full price for their gas.

Mr. Littlehales—What is the lowest day pressure you can run them with? This is a very important consideration. If it requires a large pressure, of course, the leakage during the time they may be running would be in excess even of the advantage gained by the sale of gas. I find that, with us, it requires about an inch or twelve-tenths. I suppose that will depend upon the pipes, size of the main.

Mr. Ramsdell—My experience was very similar to that. I found, after I had put that engine up, that I had made my connection too small. I ran from my main a two inch pipe, while I should have run the full size three inch pipe. It is volume that is needed and not pressure. They have very frequently run this engine when we have only had twelve-tenths on, but as a usual thing we have had to carry one and four-tenths to make the engine work at times, but that I intend to change. I have known of their being run at eight and ten-tenths, and I am satisfied that, with the proper-sized 10-10ths is ample to carry any of them.

Mr. McElroy—I would like to inquire if there is any pulsation in the main in the neighborhood?

Mr. Ramsdell—There is in an elevator building, which is about 150 feet from the engine, and there is a pulsation in the corner lamp next to the elevator, but there is none anywhere else. We are supplying gas around the same building but there is nothing within probably 300 feet of this elevator building which is consuming gas. In that distance we have had no difficulty at all from that source.

Mr. Burtis—You refer to the 17-horse power engine, do you not, as being supplied with two inch pipe?

Mr. Ramsdell—Yes. The other engine was originally put up in the third story; but they subsequently moved it into the basement. I should have done this myself; but I did not know anything about it until the work was nearly all done, and I found that the pipes, while they were ample above, were too small in the basement, and I notified the proprietor that that would have to be changed, and he has acknowledged the reasonableness of making the change. The pipes are only three-quarters of an inch.

Mr. Burtis—What is the size of that engine?

Mr. Ramsdell—1½-horse power. There was one put up at Evansville since, where the gas comes from a four inch main, and that is the one I referred to when I spoke of their running at 8 and 10 tenths pressure. That is all they carried, and the engine was working satisfactorily when I last heard from it. I do not think, where the engines are put up properly, that there is any trouble at all in getting them to do their whole work on the ordinary day pressure. I take it for granted that almost every gas company carries at least ten-tenths in the daytime. I have a number of gas stoves on. They could get along with less, but I usually carry about twelve-tenths.

Mr. Littlehales—In reference to the pulsation question, I would say that we have with us a four-horse power engine affixed to a main, I suppose, about a two inch one, for about 400 feet. At the inlet of the gas bag the pulsation is perceptible, that is at the gas bag before it enters the engine.

Mr. Burtis—Can you tell me what it costs per day to run that four-horse power engine?

Mr. Littlehales—I cannot. It has only been running about a fortnight.

Mr. Forstall—In regard to the question of pressure, I would say that we have some twelve or fifteen engines at work scattered throughout the city of New Orleans. I have made no difference in pressure on their account. We run from 8 to 10 tenths in the daytime, and we have had no complaints whatever. This question of pulsation has never come up with us. The engines are run from a separate service, but, at the same time, alongside of the service through which we supply gas for illuminating purposes, and we have never had any complaints. These gas engines are giving satisfaction in every case, and we have never had a complaint from any of them. I never

have been called upon a second time after the engines were started, even when they were in the hands of those who had never seen one before. After the first day they take care of themselves. We have them running elevators, passenger and freight, we have them in printing offices, in a paper-box factory, running sewing machines, and, in fact, doing whatever work a steam engine can do. Some are in the basement, and others are on the third and fourth stories. We put them in anywhere, and they are giving entire satisfaction.

Mr. Helme—In regard to a gas engine doing its work as well, and being fitted up better than an ordinary steam engine, I would say that when you come to make that comparison with the Corliss engine it is a pretty nice discrimination, because the Corliss engines are well fitted up. But a gas engine can take care of itself. I have seen a number of them put up, and I have yet to hear the first complaint from them. We have a promising future in this direction. There is no doubt about that. In the case of one engine that we put up we ran a separate service as Mr. Forstall did. It was a two horse power engine, and we put in a one inch service pipe and ran it back about 90 feet to the back end of the building. We started running a printing press where they had been using a water motor. They had no steam engine. Everything worked nicely and there was no trouble whatever. We ran it the first day just to see how it operated. We did not do any work with it. The next day I gave up the control of it to a man who was not familiar with machinery, but he had no difficulty in running it. There was one little difficulty that occurred but it was speedily remedied. After I left they did not attend to the engine very well, and after a few weeks constant running some of the passages clogged up a little, but that was remedied, and that is the only interruption they have had. We run along very well, with about eight-tenths, and have no complaints at all. In fact, if you have just pressure enough to overcome the friction in the pipe leading to the engine, the engine itself will work well, sucking, as it were, gas from the main with almost no pressure. I have no fear of the gas engine. The only thing is that there are a good many people who would like to try it, but they are just a little afraid. I think, however, that after a while it will become more popular than the steam engine for anything under 15 or 20-horse power.

Mr. Forstall—I should like to state that I have used the gas engine to take the sting out of the electric light. The keeper of a large saloon who had determined to introduce the electric light came to me and asked me as to what I considered the best engine to use, and I succeeded in getting him to use a gas engine as his motor power. So that we may console ourselves with the thought that even if electricity does take away some of our large customers we may still sell them gas to produce their electric light. (Applause.) I have put the consumption of these gas engines at 20 cubic feet per horse power per hour. That is about the average.

Mr. Starr—That would be 80 feet an hour or 800 feet a day.

Mr. Forstall—That is with the engine working at its full power. We have found that where the engine is working at its full working power, it will generally explode with every stroke. But when the power is thrown off and the engine is merely in a condition to operate, it will run some 15 strokes before an explosion takes place, so that the work is antomatic. The consumption of gas is in direct proportion to the amount of work that the engine is doing, up to its full power.

Mr. Somerville—In a little town in our state, Rushville, they had a small gas works. A party put up a gas engine, and turned the gas on, but it would not work. They asked me what was the matter with the engine. We were running gas engines at the time. I thought that perhaps the high specific gravity of the gas they used might account for it, and that the orifices which admit the common coal gas into the explosive chambers would not admit the high specific gravity gas in sufficient quantities, and that therfore the proper mixtures did not take place. It may be that, and it may be perhaps that their oil gas is not sufficiently purified and it may have clogged. I thought it might be interesting just to state this fact.

Mr. Ramsdell—I sold that engine to the parties in Rushville, and I sold, at the same time, an engine for an elevator in Evansville. The two engines were imported from Germany and came here together. They are just exactly alike. The engine at Rushville was sold with the perfect understanding that if it did not work it was to be taken back. The Philadelphia firm to which they belonged had not expected them to be operated by gas made from oil, and they were anxious to try the experiment. For that reason they made him that proposition. The house sent a man to put the engine up. He did so, and he found, as Mr. Somerville says, that the gas was too heavy for the machine to operate successfully. The gas should come from the slide valve and ignite. In this case it failed to do so. The consequence was that there were two or three admissions of gas before it would ignite and explode, which would not be economical. The correspondence has all been conducted between the firm at Rushville and myself, but of course I have been instructed by the Philadelphia house all the way through. We had decided to take the engine away, and I so wrote to the gentleman at Rushville. He then wrote, making a proposition for the engine. He said he would pay so much, and wanted to know if we would accept that sum, provided he could make the engine work. In the meantime I had written to the superintendent of the gas works there, thinking that perhaps there might be some trouble with their pipes or their pressure. He wrote to me, and I received the letter in the same mail that I received the one from the Elevator Company, saying that he had been there a number of times, and that the engine was working all right every time he had been there. He had seen no trouble, although the engineer, or the man in charge, told me that sometimes they could not make it work satisfactorily. Since I have met one of the members of the Philadelphia firm, and he informed me that the proposition of the Rushville parties had been accepted, and that in all probability they would retain the engine. He also informed me that they are beginning some experiments on the slide valve. They think that for oil gas there should be a larger opening, so that there will be more room for the gas to penetrate, and thereby secure an explosion.

Mr. Weare—I have been thinking over the figures that I have heard here upon the cost of motive power, and I have come to the conclusion that where there are water works, and the water is cheap, they do not compare favorably. It has occurred to my mind that it will take about 1000 feet of gas to run a 4-horse power engine a day. That would be, at the lowest estimate for gas, about $2, and from that all the way up to $3.50. The average would probably be about $2.50. Water beats that. For my printing office, running two cylinder presses and two Gordon presses, I have all the power I want for $300 a year. Therefore I do not think, unless it is in those localities where gas is remarkably cheap, that gas as a motive power can compare with motors run by water. I am satisfied that in our region it can not, because I get all the power I want for $300 per annum, and I can run day and night, if I desire, and every day in the year. I use the direct pressure from the city works. As a matter of course, the machine costs but very little—about $150.

Mr. Cartwright (Philadelphia)—Do they allow you to run the machine day and night at the same price?

Mr. Weare—Yes; I made a contract with them.

The President—That is most extraordinary.

Mr. Weare—I have all the water I want at so much a year.

Mr. Littlehales—Are they gravitation water works, or is the water pumped?

Mr. Weare—It is direct pressure from the works.

Mr. Cartwright—Is the water pumped by steam?

Mr. Weare—Yes, sir.

Mr. Helme—I hope Mr. Weare will not mention that too much in the town he comes from. In a place where I have a gas engine running a printing press they raised the water 330 feet, and they gave him an elevation of 40 feet besides. When they come to put the meter on they found that the water company was losing about $4 a week over the actual cost of pumping the water. That is was put the gas engine in. I think that if they put the meter on your apparatus the same result will be discovered.

Mr. Weare—They have done that already. They formerly furnished me for $250; but they put the meter on and raised me $50.

The President—Of course, yours is a special case, and cannot be cited as being of general application. It probably does not apply to any other city in the world. I am sure that in our city they would not allow you to run twenty-four hours at the same price they would six, and I do not believe any well managed corporation would.

Mr. Weare—They get a good compensation for their water.

Mr. Helme—To what height do they raise the water before it reaches you?

Mr. Weare—My power is on the first floor.

Mr. Helme—Are you pretty low down toward the level?

Mr. Weare—I am, perhaps, a little low.

Mr. Helme—That is another case altogether. It makes a great difference, placing your motor down on the level that they elevate the water from. You get the benefit of every foot they raise. In the case I speak of they actually raised it 300 feet before we got one pound of pressure to operate the motor, and it was necessary to raise it about 40 feet higher before the motor would run. There were three motors in the building, all running printing presses, but when they put two of them on neither of them would run, and when they put on three they would have to compromise with each other and make arrangements for somebody to stop while the others went on.

The President—That city is a small one, of course, with a good deal of power and a good deal of capacity above the necessities of the town. In Cleveland they will not do a great deal of business in the way of selling water. They have not got the water.

Mr. Ramsdell—I will say that these parties who are using the engine in Evansville also have water power. I am not very familiar with the different

kinds of water power, but whatever they had they have set it aside and put the gas engine in its place.

Mr. Helme—Did you ever compare the actual power obtained from them with what the makers claim for a steam engine?

Mr. Ramsdell—No, sir, I have not.

Mr. Helme—Do you think that you obtained 17 horse power from your engine?

Mr. Ramsdell—I could not say; I do not know how that is.

Mr. Helme—You have no means of comparing it with some other elevator in that neighborhood?

Mr. Ramsdell—That is the only elevator there. The engine does all the work. It runs a large corn sheller, and drags the corn about 300 feet, which requires more power than the sheller does. When we were estimating the power necessary, we were calculating for the sheller itself. We made no figures on the drag. But we found that it did all the work successfully in both cases, and did both things at once.

Mr. Helme—I am pretty well satisfied that you get all, or very nearly all, they claim.

Mr. Weare—I would like to inquire why it is that there is so much difference between the cost of a gas engine and the cost of a steam engine. I can purchase a steam engine, say of 4-horse power, complete, for $350. Now, the gas engine costs more than that. It costs, I believe, about $400. I rise to ask why it is that there is such a difference in the cost. Certainly, one has the expense of a boiler, and the other has no boiler.

The President—Do you mean to include the boiler when you say that you can purchase a four horse power engine for $350.

Mr. Weare—Yes, sir; I can get a four-horse power engine, all complete, for $350.

The President—New?

Mr. Weare—Yes, sir.

Mr. Helme—I have thought that matter over a good deal, for I have a lively interest in the engines. In the first place, these gentlemen have to pay a very large royalty. Besides that there was a large amount of money spent in making experiments, and getting the engine down to its present condition. It was at first imperfect, and a great deal had to be done, and much money had to be spent to make it what it is. They tell me that the company that bought out the patent paid the man for all the expense he has been to in experimenting for these many years. Another thing is that Mr. Ramsdell compared the engine with the Corliss engine, and spoke as if it were fitted up in a superior manner. I call that in question.

Mr. Ramsdell—No; I don't think I said that.

Mr. Helme—I so understood it, but perhaps I am wrong. There is another thing about it. A gas engine is propelled by explosion, consequently, it requires stationary rods and stationary bed plates perfectly fitted. A steam engine, as we all know, receives the steam slowly, and the strain is very much less sudden and severe than in the case of the gas engine. Therefore, I think that the cost of the gas engine is largely due to the workmanship that is required. It is something like an engine that they are now running in Philadelphia. It is what they call a high speed engine. They are large engines. I saw one at Johnstown the other day. It was four feet stroke, and made 125 revolutions per minute. They told me that it had not cost a dollar for repairs in two years. They are very fine engines. I must say I never saw superior workmanship or better designs than I saw on those engines, simply because they are put to such a severe test that they are obliged to have the most careful work upon them.

The President—It is very difficult to institute a comparison. You say you can buy a four horse power engine for $350; but then you have to take into account the labor, repairs, etc., before you get at the cost of it. I have heard of an engine and boiler which cost $125, but which proved to be very dear in the end. So it might be that this $350 boiler and engine might prove to be very dear in the long run, compared with an engine that cost twice as much.

Mr. Ramsdell—I would like to say just one word upon this point. The cost of the gas engine is largely owing to the labor upon it, as Mr. Helme has suggested. In the case of the 17-horse power engine, the cost is $1385. The cost of the Corliss engine, I believe, is $1320, without the boiler, or smokestack, or any of those things—just the engine alone. So you see there is only a difference of $65 between the two engines. On the four-horse power engines the difference in the amount of labor is very little, and the difference in material is considerable. Of course, a large engine is heavier in all its parts to sustain, as has been suggested, the effect of the explosion.

Mr. Somerville—I would like to state a fact that took place. There was a party who brought all his machinery and apparatus that he had employed from Cincinnati. He left his power behind, but brought all his other things with him; and, by-the-way, he showed a happy foresight. The power that it took to run his machinery was a one-horse power. A question was raised whether a gas engine of that capacity would run his machinery and we were led to try it. We fixed him up and put a gas engine on his machinery, and it worked admirably.

Mr. Neal—I have been much interested in listening to Mr. Ramsdell's paper, and to the statements of those who have had experience in gas engines for motive power; but I have waited to hear something from these gentlemen in regard to the working of these engines in their exhauster rooms. It seems to me that they are very ready to induce others to use the engines, but are not so ready to use them themselves. Now, where they supply gas to other parties they charge a profit on it. If they could use the engines in their works as a motive power they would simply have to charge at the rate the gas cost. I would like to inquire of Mr. Ramsdell, or Mr. Forstall, or any of these gentlemen who have been disposing of gas engines to their customers, if they have used them themselves in their exhauster rooms, or anywhere about their works for motive power?

Mr. Ramsdell—So far as I am concerned I have studied the matter over very thoroughly. I wanted to put one in; but I wrote to the parties who made our exhauster and they told me that they did not think it would work steadily on account of the fact that the gas engine runs at a continuous speed. There would be no variation to accommodate itself to the exhauster, and I gave the matter up. At that time we were expecting to crush our coke, and I intended to put up one of these gas engines, but we made a contract with the parties who took our coke, and we have nothing to do with it. Apart from the use in the exhauster room, if I had an opportunity to use it, I should certainly do so.

Mr. Neal—When I have conversed with people about these engines I have always recommended them; but I am met by the inquiry if I am using them in the works under my charge. I have given the same reason that Mr. Ramsdell has; but that does not seem to satisfy them. It seems to me, with all the improvements in gas engines, some arrangement could be made by which we could run our exhausters with them. We have two engines in our exhauster room, of five-horse power, which I would be very glad to substitue gas engines for, provided they would work satisfactorily, and run the exhausters so as to take the gas as it came and accommodate themselves to the volume of gas passing through them. I hope that these gentlemen will consider the matter and endeavor to find some method by which it can be done. We would then, I think, have much more influence and success in persuading others to use them. We could say to them that they are operating very successfully at our works, and that we would be glad to have them call and examine them. We should then be far more likely to induce people to take them. That would certainly be the case in my district. When I tell our people why we do not use them, they are not at all satisfied, and they reason in this way; if they do not use them at the gas works it must be because they are more expensive than the steam engines, or there must be some trouble about it.

Mr. Littlehales—I think the objection to adopting gas engines in exhauster rooms is self-evident. As a general rule breeze from coke is valueless when offered for sale; but it becomes very valuable fuel to the company itself. In our case we use for fuel the small breeze from the coke heap. It would be valueless if offered for sale, but it is of great value to us to use as fuel.

I do not think there would be any practical difficulty in running exhausters with these gas engines, because, although they run at a fixed speed, a properly adjusted compensator would get over the whole difficulty. It is a practical question, however, of having the fuel on hand. Most gas companies, like ourselves, have, I suppose, a large amount of material already on hand that is valuable for fuel, but which, if not used for that purpose, would not be worth a dollar.

Mr. Helme—I do not think that accounts for it. I think there is a mechanical difficulty in the way. That matter has undoubtedly occupied the attention of every mechanic in the Association. I have thought about it a good deal. The matter has been before the attention of gas engineers in England. There is a real practical difficulty in the way of making it work as satisfactorily as a steam engine. This uniformity of speed is the trouble that must be overcome. I think it is 180 revolutions per minute that they are rated at. The engine does not take gas at every revolution, or every other revolution. It takes no gas until it gets below that. Now, the difficulty is to get a varying movemement from that fixed speed which will accommodate the exhauster to the amount of gas being made and being brought forward. Some gas engineers of London have adopted a device with a sliding arrangement which slides over a large diameter; but it seems that even that does not work satisfactorily. It does not operate quickly enough. We are going to charge two or three benches of retorts. We have got to where there is no gas coming, but the machine is working rapidly. Presently a large volume of gas is sent forward to the exhauster which the exhauster cannot take up quickly enough. With a steam engine this is easily regulated and with but little variation. There are many exhausters which run from one end of the year to the other with scarcely any variation. There is a purely mechanical difficulty which Mr. Littlehales has not ac-

counted for at all, and there is a field for Mr. Neal and others to exercise their wits upon—to devise some mechanical contrivance that will overcome the difficulty.

Mr. Littlehales—The best answer to that argument is that within the last four or five years they have been using quite a number of gas engines for running exhausters.

Mr. Helme—I am glad to hear it.

Mr. Littlehales—It is being done; and I do not think there is any serious practical difficulty in the way. Of course, if the works are so conducted that a number of retorts are charged at once, and then there is quite an interval when there are none charged, I should consider that a defective arrangement, and should think it not improbable that some trouble might arise. But that is a defective arrangement in regard to charging, and is not a mechanical difficulty.

Mr. Helme—I have not before heard that the gas engine has proved satisfactory across the water when used in the exhauster room, though I am certainly glad if it is the case. I have known of its being applied to exhausters over there, and of their attempts to make improvements that will obviate the difficulties I have referred to; but all the information I have upon the subject is to the effect that, even with the improvements they have introduced, it does not work satisfactorily when applied to exhausters, and I do not think that the mechanical difficulty which I believe is inherent in the machine has yet been entirely overcome.

Mr. Starr—I think the difficulty might be obviated by having a compensator, so that when that large volume of gas comes it will close itself automatically.

Mr. Helme—It is not economy in the right direction to introduce a thing which requires to do as much work when you are working a little gas as when you are making all you can.

Mr. Starr—Nevertheless, you may have to do it.

Mr. Helme—I do not believe that compensators would be found to work satisfactorily on gas engines that were running exhausters.

Mr. Ramsdell—I have gone a little further, in regard to a governor for gas engines. We had a communication from a party who seemed to find the use of the machine very expensive. I gave him a description of the engines in use in our place, and he suggested something which I think will overcome the difficulty. It looks reasonable. So far as the compensator is concerned, I will say that we used a governor in crushing our coke, and it worked perfectly. I cut off the governor from the crusher, and put on a compensator, and the guage shows less pulsation with the compensator than with the governor.

The President—I will say, in regard to this matter, that most gas companies, having made all their arrangements years ago, use a steam engine, being obliged to use a large amount of steam for heating their works, and they have gone on with them, at the same time recognizing, in many cases, the superiority of gas engines in many respects. Take my own case, for example. Years ago our works were fitted up with engines and boilers, and we were obliged to run them when we got to the point where the directors are willing we should make a change. Engineers and managers of gas works cannot always do exactly as they would like in the way of introducing new things. The directors have to be considered. So far as my experience goes in advocating the introduction of these engines among our people, I have met with no objection on the ground that they are not used in our works. That is the difference between Cleveland and Boston. Boston people are much sharper, and they seem to corner Mr. Neal in that way. But they do not trouble me in that manner in Cleveland. We are about to put in a 2-horse power gas engine in our works, and it may prove a strong argument in the way of inducing other people to try it. The great difficulty and the great bugbear with our people is the cost of the gas. They are afraid of their gas bills. I have never met with any more serious objection than that.

Mr. Neal—If you were able to tell your people that the engine was employed in your works, and to show them results, would you not be more likely to induce them to employ it?

The President—Perhaps so; but, as I say, I have never been met with that objection.

M. Starr—I would like to inquire whether you have had any complaints from parties for whom you have put in these engines?

The President—Last spring a party wanted us to put in a gas engine for the purpose of elevating. We were in negotiation with two or three firms in regard to it, but we could not get the right sort of engine in time to meet their demands. Some mechanics who got hold of the job succeeded in making the party believe that a two-horse power engine was sufficient to run the elevator. I told him it was not, but he insisted that he knew all about it. He put it in, but it did not prove to be sufficient. It had a dampening effect for a time, but we put a 4-horse power engine in, and they are running it now.

Mr. Starr I had some experience with one. Last February I put one in for a firm in our place. It was in use about six months, and the firm died. I have that engine now.

The Secretary—As this matter has apparently been discussed at sufficient length, I desire to call the attention of the Association to another matter. I have, during the past year, been notified of the death of six members of the Association, as I stated yesterday, but I did not then announce their names. It seems to me that it is simply a matter of duty upon our part to take some official notice of the death of these gentlemen. I now respectfully notify the Association of the death of Mr. John O. Buxton, who died July July 21, 1880, of Mr. George Buist, who died November 2, 1879, of Mr. George W. Edge, who died January 1, 1880, of Mr. Lazarus Noble, who died in June, 1879, of Mr. O. G. Steele, who died November 11, 1879, and Mr. Kerr Murray, who died in the spring of 1880.

I would respectfully move you, sir, that the first hour of the evening be set apart for any obituary remarks that the members of the Association may desire to make, and that the same be incorporated in our minutes. I will say that Mr. Page was to talk to us to-day upon the subject of coal tar and its products; but he has consented to take the evening session for his remarks. He will then have an opportunity of showing you the answer to the question that is not infrequently asked of how aniline dyes stand electric light and gas light.

Mr. Cartwright, of Philadelphia—There was a subject laid upon the table yesterday, and that was a proposed amendment of the constitution in regard to the time of meeting. I move that that matter be now taken up and disposed of. (Carried.)

The Secretary—As it stands upon our minutes the proposition is to amend the seventeenth article so as to strike out the word "October," and insert the word "May," making the annual meeting the third Wednesday in May instead of the third Wednesday in October. An amendment was affixed changing this to September, and the original amendment, as well as the amendment to the amendment, are open for discussion.

Mr. Starr—I think that amendment was withdrawn.

Mr. Denniston—I understood that my amendment was amended.

The Secretary—General Hickenlooper offered an amendment making it April.

The President—That question is now before us, and I adhere to the ruling of yesterday that the resolution may be amended at this time.

Mr. Denniston—While on the floor I would simply state that I advocate the latter part of September because that is at a time when we can be more readily spared from our business than at any other time, or a time when we can get away better than we can in October. As suggested by the Committee, May is a very good time to be away from our works; but there are other Associations which have already fixed their time because this Association has heretofore met in October. Of course it will not be necessary for the National Association to give way to the other Associations, but it would be well for us in fixing upon a time to fix it definitely and permanently so that the other Associations throughout the country can also have a fixed time, and so that they will know what they are doing when they change their constitutions to meet the present emergency.

The President—The specific question now before us is upon General Hickenlooper's amendment to your amendment. His proposition was to amend your amendment so that the meeting should be held on the third Wednesday of April of each year.

Mr. William Cartwright—I hope, for one, that the amendment will not pass. Our year closes the first of April, and that would prevent me from attending the meeting in that month. So far as I am personally concerned, if there is to be any change at all, the month of May or the month of September would be preferable.

The President—I very much question the expediency of fixing the time for our meeting in April for the reason that in the more northern sections of our country the snow has not left the ground.

Mr. Spencer—I hope that the time of the meeting will be left just where it is. I think, taking all the circumstances surrounding it into consideration, we cannot do better. I am certainly opposed to taking as early date as the month of April.

Upon a vote being taken the amendment of General Hickenlooper to the amendment of Mr. Denniston was lost.

The President—The question now is upon the amendment of Mr. Denniston making the time of the annual meeting the third Wednesday of September.

Mr. Burtis—I think the third Wednesday in September is objectionable for one reason. The superintendents of many of our small companies have to be at home about that time. Our bills are made up to the first of October. I think an earlier day in September would be very much preferable than the third Wednesday.

Mr. Butterworth—I think it is much better to keep the meetings as they are now. It has worked very well thus far, and I see no reason for a change. I suppose it would be inconvenient for some of the members to attend no

matter when the meeting was held. I do not, however, object to an earlier date so far as I am personally concerned. In reference to our Western Association I will state that when, in its early days, this Association fixed its place of meeting in the city of New York, some of us out here could not very well afford to go, and we got up a little society of our own and fixed the time of meeting in May. We do not get to work until after the 4th of July. It would suit us better to have the time early in the spring; but if it is to be in the fall, I think it would be better to let it stay where it is.

Mr. Starr—If we fix the time in September we are likely to be troubled with very warm weather. It is, for that reason, a very unpleasant mouth to be away from home.

Mr. Denniston—I do not wish to insist upon a change to September. My amendment was simply a compromise amendment. There are a number I know who are opposed to having the meeting in May. For my own part, as I have said, it would suit me as well to have the meeting in October as at any other time, and I suppose a large number of us could attend as well in October as in September; but if there is to be any change at all I, for one, do not want the time fixed in May. I should greatly prefer September, and I should rather have it in October than in May.

The President—I remember that when the time was fixed in October, there was a good deal of discussion, and, at that time, it was thought to be the best date, on the whole, that could be fixed upon. It suits our New England friends remarkably well.

I should like, at this point, to make an explanation of the change in the time of meeting this year, The regular time of meeting was the 21st of October. I corresponded with the President of the company in Chicago, who was Chairman of the Committee of Arrangements, in regard to the matter. He wrote to me repeatedly that it would be very inconvenient to have the meeting held here at the regular time. He said that there were other associations to meet here at that time, and it would be difficult to get the proper accommodations at the hotels, and that, as for himself, it would be very much more convenient for him. I did not feel at liberty to change the constitution, and I corresponded with the members of the Executive Committee, and they all approved of bringing the meeting forward one week. It is clearly an impeachable offence, and I plead guilty to it; but, perhaps, under all the circumstances, it was the best thing that could have been done. I am, however, very sorry to learn that it has been the cause of keeping many of our New England friends away from this meeting. This explanation is due to the Association in order that the members may understand why that liberty was taken with the Constitution. The question now is upon Mr. Denniston's amendment.

Mr. Somerville—I am opposed to the change. One reason is that the American Gas Light Association is an established fact, and we ought to arrange our work so that we can attend the meetings at the time fixed by the Association. I do not like the idea of changing. It looks like a want of stability. If we change now we may want to change again by-and-by. For my own part I can get away better then than at any other time, for during the spring and summer work is going on that requires my special attention. In October everything is prepared for the winter, and I can leave better then than at any other time of the year.

Mr. Parkhurst—There seems to be a good deal of difference in regard to this matter which does not seem to me to very important; and, in order to test the sense of the Association, I move you, sir, that action upon this matter be indefinitely postponed, and thus leave the matter just where it is. (Lost.)

The President—The question now is upon Mr. Denniston's amendment, which, I believe, is well understood by all.

Upon a vote being taken the amendment was lost.

The President—The question now is upon the amendment proposed by the Executive Committee substituting the third Wednesday in October.

Upon vote being taken the proposed amendment to the Constitution was not adopted.

The President—We will now listen to Mr. Weber upon the subject of "Gas Furnaces."

Mr. Weber then spoke as follows:

Our Secretary has stated I was to read a paper; but, owing to a slight misunderstanding, I have not been able to prepare one. I have, however, some drawings with me of gas furnaces of various descriptions which I would be happy to exhibit to your attention.

You are, of course, all aware that Siemens was the originator of the use of gas to any extent in the manufacture of iron and steel. When he had achieved great success in this direction he woke up all the scientific and practical men engaged, not alone in the manufacture of iron and steel, but in other industries. It stirred them up as the electric light did the manufacturers of gas a few years ago. It has employed the thoughts of men of science for the last 15 years to make the use of gas a success in other branches of manufacture. There are now some 15 or 20 scientific men devoting their time exclusively to the work of making gas available for other purposes, with whose names you are probably more or less familiar, such as Muller & Eichelbrenner, in retort benches; Muller & Fichet, in regenerating bone for refining and clarifying purposes, and also in applying gas as fuel to boilers; Steinmann, in gas generators and in the manufacture of wood gas; Lendin, in the use of sawdust as fuel; Boetius, in the manufacture of crystal and window glass; Steinmann, in connection with lime-kilns; Hodeck, in gas as a fuel in the production of carbonic acid; Mehse, in the manufacture of porcelain; Moller & Mendheim, patentees of gas kilns for the Royal Porcelain Manufactory, Berlin, Germany; Bührer, in the manufacture of terra cotta ware, fire bricks, etc; Mohr, of the Continental Gas Company, Stettin, Germany, in retort benches; Liegel, of the Stralsund Gas Works, Germany, in retort benches, and in the application of gas as fuel to boilers; and Dieterich, of the Peoples Gas Light Company, Baltimore, Md., in retort benches.

These men have expended considerable time and money in the production of furnaces of different constructions, as best applied to the uses and purposes intended. As before stated, I have some plans of improved gas regenerating furnaces, showing their construction in detail, and of which there were two erected last year at the Metropolitan gas works, in New York city. They are known as the Liegel Furnace, and patented in Europe and the United States, by Liegel of Stettin, Germany. His authorized agents for this country are Messrs. Eppelsheimer & Huttner. These furnaces were put up with the understanding that they were not to be accepted if they did not perform their work satisfactorily. The same company has contracted with me for the erection of twenty-four of these furnaces this year (applause), and have paid me for those put in last year without a word of objection. These twenty-four Liegel furnaces, and two on the system of Muller & Eichelbrenner, the latter improved upon by Mr. Strecker, assistant superintendent of the works, were built in the same stack of benches, and will be fired up in two or three weeks. The patentee (Liegel) guarantees that 17 to 18 per cent. of the coke carbonized is sufficient fuel, and not only that, but also guarantees that the furnaces will produce a higher heat than those on any other system. Some of the advantages claimed for this furnace over the old grate furnaces are as follows, as set forth in the pamphlet—

1st. Saving of about 50 per cent. in fuel when compared with ordinary grate furnaces, using the same kind of coal, having the same number of retorts, and producing the same amount of gas.

2d. Any degree of heat can be obtained. By this the productiveness of the retorts can be increased as far as the illuminating power of the gas, the quality of the tar, or the material of the furnace will allow.

3d. Greater durability of the furnaces, as the walls and the fused slag do not come in contact.

4th. Automatic cleaning of the fire from the slag, by the fusing of the latter, which lessens the labor of the firemen.

5th. Abolition of the grate.

6th. No water required in the ash pan.

7th. Continuous or intermittent firing, as desired. There is no necessity for drawing the fire, even for stoppages of 72 hours' duration, during which no watching is required.

No strong draft is needed. The dimensions of the old grate furnaces and retorts may be retained in replacing them with the Liegel furnace. The depth of the generator furnace below the floor line is from 5 to 7 feet. The deeper ones are worked more advantageously.

The pamphlet also contains reports of working results of furnaces, constructed on this system in 1879 in England, France, Germany, Russia, Sweden, Italy, and Hungary.

Here are plans showing the construction of a gas generating furnace on level ground and within two feet of the surface. This furnace is to be recommended in cases where an underground furnace would be impracticable, owing to water. They can be constructed in any part of the retort house, and even outside of same, should the retort house be too small or so located that the furnace cannot be attached to the benches, and the gases drawn into the benches as shown on the plans. They will be found very adaptable in small works, where they can be attached to the side or rear of existing benches without disturbing them in the least. Where the erection of a new stack is contemplated, the best position for this furnace would be in the centre of the stack, or on both ends, from which the gases could be drawn into the respective benches in use.

In the construction of this furnace it would be necessary to carry up the height of the chimney on the generator to 15 or 20 feet, in order to insure sufficient draught. It would also be necessary to carry up the height of flues on the top of the benches to at least 10 feet, which additional height could be provided by means of a removable (at will) sheet iron pipe. The idea is to furnish sufficient draught to commence with, and when the desired heat is attained the extra length of pipe can be dispensed with. In the Liegel or underground furnace no necessity exists for any increase in height of flues, and, the heat remaining in the bench, there is no loss of heat by radiation, whereas in the overground generator, unless built

directly in connection with the benches, loses heat by radiation in traveling the distance between benches and generator; although under this disadvantage, it claims a saving of 30 to 35 per cent. as compared with the old system of firing by distinct furnaces for each bench, in economy of fuel, higher heats, and increased durability of retorts and settings.

If the members of the Association will ask me questions I shall probably be able to explain the matter to them more satisfactorily.

In Europe to-day the system of heating with gas in continuous furnaces is almost universal. Mr. Mohr, of Stettin, Germany, whose company have works established in some 17 cities and towns in Germany and Russia, has adopted this overground furnace system in the most of his works. Mr. Buhrer, of Konstanz, Germany, has put up over 200 furnaces on this system within the last few years, and he writes me that he has some 40 men erecting them all over Germany, France, Italy, and Switzerland, not alone in the gas industry, but also in glass, porcelain, and terra-cotta works. I carried on correspondence with Mr. Mohr quite a number of years ago, and wrote him that some of our gas companies could not dispose of their coke that they made under the old system to advantage, and on account of the increased production of coke under the new system, it would be a still greater drug on their hands, and on that score would not take hold of the furnaces. He replied to me that it would still pay the companies to use the new system, even though they should be compelled to sell their coke at a disadvantage, or be forced to give it away.

I erected two furnaces on this system in a chemical works in Brooklyn, which are now working very satisfactorily. I think I will have one in New Haven for Mr. Sherman, and also some more in Brooklyn.

Here is also a plan showing the Liegel furnace in connection with a steam boiler, which is to be erected in the sugar refinery of Messrs. Havemeyer and Elder, in Brooklyn, conceded to be the largest sugar refinery in the United States. We have agreed to erect this furnace under the condition that it shall evaporate 12 pounds of water per pound of coal.

The patentee's pamphlet reports a test made in Switzerland, under a boiler having 435.57 square feet of fire surface. After having passed around the boiler, the hot gases pass around two mud-drums, with 242.74 square feet of surface exposed. The water which is fed into the drums is 65.3° F. Steam pressure, 59 pounds; fuel, Rhenish coal. The boiler had formerly a common grate, and evaporated 7.26 pounds of water per pound of coal. After having changed the fire-place or furnace to such a one as used in his generator furnaces, without changing the other mason-work, a trial of 360 hours was made. The water evaporated was (all other circumstances being the same) 12.11 pounds per pound of coal, which represents a saving of 40.05 per cent. The feed water was measured by a meter of Siemens and Halske, made for this purpose, and showing units of 10 litres (about 2½ gallons).

These furnaces, if properly taken care of, will work satisfactorily for five or six years without necessity of renewal, and the retorts being more uniformly heated than by the old furnace, will distil more coal with less production of carbon and tar, thus, consequently, prolonging the life and durability of the retorts.

Of course, it is against my personal interest to say this, because you are gas men, and quick to see objections and disadvantages.

I think the time is near at hand when all fuel will be converted into gas, and that it will be used to much better advantage as a fuel for heating in gas works as well as in other industries, because any desired intensity of heat can be attained, which is not the case with furnaces of present construction. Another advantage is that any kind of coal, coke, or carbonaceous material can be used.

Europe has not been favored with the quantity of coal that is wasted in this country, and the Europeans have been compelled to utilize their material in the best possible way, and they are forced to utilize it in such a way as to produce the best possible results. I venture to say that in five years from this time you will have become so thoroughly convinced of the advantages of this system that you will have adopted it almost universally.

Any information you desire I shall be most happy to furnish. I have a number of plans with me that I shall be glad to have you examine, and I will cheerfully explain them if they need explanation. I feel that an apology is due the Association for these somewhat disjointed and discursive remarks, and if I have failed to make myself understood by some of the members, I shall be happy to explain to them in person.

The President—If there are any points in regard to which any of the members of the Association are in doubt, they can now proceed to question Mr. Weber in relation to them.

Mr. Weber—I will say that improvements have been made upon these furnaces from year to year, until they have reached their present point of perfection.

Mr. Allyn—I would like to inquire of Mr. Weber if he knows what royalty these parties ask for their process.

Mr. Weber—The royalty which they charge the Metropolitan Gas Company is $100 per bench, and the Company has the privilege of replacing these benches as often as they please without further charge. I think they will raise the royalty to $200 per bench, or they will arrange it in this way: They say, "We will take your statement of your works for the last year, and we will take half of the proceeds of what we can do for three years, and you will pay us at the end of each year for that year's work." That is very little. That is the understanding I have had with them.

Mr. Cartwright (Philadelphia)—How long has the Metropolitan Gas Light Company used these furnaces?

Mr. Weber—They were built last year. I built them at my own risk, because I could not get anyone to use them in any other way. They were put up subject to the approval of the President and Engineer of the Company.

The President—Mr. Cartwright's inquiry was as to how long the furnaces have been in use in the Metropolitan works.

Mr. Weber—Since last July, and they have been working satisfactorily.

The President—If there is no further discussion of Mr. Weber's remarks, the Secretary will now proceed to read a paper prepared by Mr. Edgerton.

[To be continued.]

Electricity in Collieries.

Mr. W. H. Preece, President of the Society of Telegraphic Engineers, has addressed the following important letter to the *Times* on this subject:

Sir—Several correspondents recently advocated in the *Times* the employment of electricity for illumination in collieries. One suggests that portable lamps made of a battery and a vacuum tube should be employed. Such lamps have been tried frequently, but they have failed from want of permanence in the current and intensity in the light. I have seen excellent lamps of this form, notably one made by Breguet, of Paris; but they proved much too feeble in illuminating power and practice. Others propose the use of the electric light on the assumption that such a light is safe.

It cannot be too strongly insisted that the absolute safety of the electric light is a popular delusion. In the first place, the arc itself is the greatest source of heat which science possesses, and, in the second place, the wires conveying the electric currents that produce the arc may themselves be conveying energy in a form as insecure as a train of gunpowder. The danger of the electric arc is supposed to be removed by its insertion *in vacuo* in hermetically sealed glass bulbs; but what if these bulbs be broken, and what about the difficulty in maintaining the vacuum? Granting, however, that it be practicable to immure the light in a secure transparent vessel, what about the wires?

The currents employed to generate the light are extremely powerful, in some cases many thousand times stronger than those employed to work telegraphs. Not long ago a poor musician in a theatre in Birmingham, and quite recently a poor Russian sailor on board the "Livadia," were killed by incautiously seizing upon certain exposed parts of the conductors conveying these currents.

The difficulty in maintaining currents in their proper path in telegraphy is very considerable. How much more difficult must it be to maintain those employed for electric lighting! Copper wires are carefully inclosed in india-rubber or gutta-percha coatings, but these insulating coatings are liable to injury; they are inflammable, and if a mere crack or pin-hole were to occur in such a coating the currents would escape to earth, generating heat and producing fire.

This view is not chimerical. Offices have been set on fire even by the currents employed in telegraphy. I know of two such cases, one in New York and the other in Boston. It is not at all unlikely that the recent fire in Manchester arose from such a cause. The liability to such accidents is evidently much greater with electric lighting, and it is only technical knowledge and professional skill which can render such currents innocuous even in well-constructed buildings. In mines, however, the difficulty is much greater. There the wires must necessarily be suspended in narrow, frequented galleries close to the damp earth, and be liable to incessant injury, and they could be rendered comparatively safe only by costly cabling. It would be impossible to guarantee absolute security. To light a colliery by electricity would therefore be both costly and dangerous.

The popular delusion as to the safety of the electric light is probably due to its being so frequently spoken of as a cold light, the word "cold" being used in its figurative sense of cheerless, the unscientific taking the word in its literal sense.

There is reason to believe that electricity plays another important part in colliery accidents. Some months ago there was a terrible disaster in the Risca colliery in South Wales; over 70 human beings were hurled into eternity. An inquiry was held into the cause of the disaster, and the conclusion arrived at was very unsatisfactory. A well-known telegraphic engineer, Mr. Arthur Redcliffe, from evidence collected on the spot, arrived at the conclusion that the mine was discharged by a flash of lightning. He

submitted his evidence to me, and I fully concurred with him. All the conditions for such a catastrophe were present. The flash of lightning was seen to strike the head-gear of the shaft immediately before the explosion. This machinery was connected with the bottom of the shaft by several continuous conducting masses. Iron rails, resting on poorly conducting matter, extending thence throughout the galleries. The gas was there, and it only wanted a break of continuity in the metallic masses conveying electricity, of which there were many, to produce sufficient heat to fire the charge.

I have no doubt that lightning was the cause of the explosion. These facts were submitted to those who were concerned in the inquiry; but probably, being incomprehensible to them, they were ridiculed and therefore ignored. Hence I advocate the employment of well constructed lightning conductors over the head gear of shafts to keep electricity out of the colliery and to insure safety, rather than the erection of conductors along the galleries to convey it in them for purposes of illumination and to court danger.—London *Iron*.

Classification of Steels.

The Société Cockerill, of Seraing, Belgium, arrange their steels into four classes :

1st Class. Extra mild steels. Carbon, 0.05 to 0.20 per cent. ; tensile strength, 25 to 32 tons per square inch ; extension, 20 to 27 per cent., in 8 inches of length. These steels weld, and do not temper. Used for boiler plates, ship plates, girder plates, nails, wire, etc.

2d Class. Mild Steel. Carbon, 0.20 to 0.35 per cent. Tensile strength, 32 to 38 tons per square inch. Extension, 15 to 20 per cent. Scarcely weldable, and hardens little. Used for railway axles, tires, rails, guns and other pieces exposed to heavy strains.

3d Class. Hard steel. Carbon, 0.35 to 0.50 per cent. Tensile strength, 38 to 46 tons per square inch. Extension, 15 to 20 per cent. Do not weld, but may be tempered. Used for rails, special tires, springs, guide bars of steam engines, pieces subject to friction, spindles, hammers, pumpers.

4th Class. Extra hard steel. Carbon, 0.50 to 0.65 per cent. Tensile strength, 46 to 51 tons per square inch. Extension, 5 to 10 per cent. Do not weld, but may be strongly tempered. Used for delicate springs, files, saws, and various cutting tools.—*Abstracts of Institution of Civil Engineers.*

Gas Exhibition at Glasgow, Scotland.

As previously noted, the exhibition under the auspices of the Philosophical Society, was opened on September 28th. All the accounts received of this exhibition concur in the verdict that it was most successful. The leading local paper, the Glasgow *Herald*, devotes several columns to a description of the opening, and comments editorially as follows :

"More than ordinary interest attaches to the gas exhibition which was opened in our city yesterday. It is unquestionably the largest display of the kind that has ever been made in this country ; but it is something more. Its promoters have managed to illustrate, with a completeness reached on no other occasion, the varied uses to which coal gas may be applied, not merely as a heating or an illuminating agent, but also as a motive power. They have further afforded a rare opportunity for comparing lighting by gas with lighting by electricity. Side by side the later developments of the rival lights are to be seen, and though the exhibition may not do much in the way of solving the question whether the new illuminant is destined altogether to eclipse that bequeathed to us by the inventive genius of Murdoch, the Ayrshire millwright, there is no doubt as to the extreme interest of the spectacle. On the whole, the Philosophical Society are to be congratulated on the successful manner in which their plans have been laid and carried out. To have any permanent value an exhibition of this kind should be thorough and comprehensive in its character, and these are precisely the qualities possessed by the collection at the Burnbank Hall. There is a fitness also in the exhibition being held under the auspices of a Society which took an active interest in the development of coal gas at an early stage of its history."—Glasgow *Herald*, Sept. 29th, 1880.

Food Adulteration.

Through the efforts of the *Sanitary Engineer*, the National Board of Trade, at their annual meeting in Washington last December, were induced to institute a competition for "the best Act or Acts, accompanied by an essay, designed to prevent injurious adulteration, and to regulate the sale of food, without imposing unnecessary burdens upon commerce." One thousand dollars was offered in prizes, which sum had been given to the Board for that purpose by Mr. F. B. Thurber, of this city. The terms of the competition were published in the *Sanitary Engineer*, and the necessary details were taken in charge by that journal.

The competition closed October 1st, and the Committee of Award, consisting of John S. Billings, Surgeon U. S. A., Vice-President National Board of Health ; Prof. Chas. F. Chandler, President Board of Health of New York ; ex-Chancellor B. Williamson, of New Jersey, and A. H. Hardy, Esq., of Boston, have just made their report.

In addition to awarding the prizes, the committee were required to prepare and submit to the Board of Trade a draft of a suitable National and State Bill designed to secure the results which the competition was instituted to accomplish. It is believed that no abler or more competent committee could have been selected to perform this difficult and delicate task, and it is therefore to be hoped that the laws which they recommend will soon be upon our statute books. The report of the committee, the draft of the bills, and the prize essays will be found in the *Sanitary Engineer* of Dec. 1, 1880.

Sanitary Rules for Public Buildings.

The following rules, to be observed in the construction of all buildings erected under her Majesty's Office of Works, have been prepared and issued by the Secretary to the Office of Works—

1. All water-closets and urinals shall be constructed so that one wall at least of such closets and urinals shall be an outer wall of the building.

2. All soil pipes shall be carried outside the building, and ventilated by means of pipes leading the foul gases above the highest point of the building. Such pipes to be carried to points removed from chimney stacks.

3. Separate cisterns shall be constructed for the water-closets and for the general purposes of the building. No tap or "draw off" shall be affixed to any pipe communicating with a cistern supplying a water-closet or urinal.

4. All waste pipes and overflow pipes of cisterns shall terminate in the open air, and be cut off from all direct communication with drains.

5. Great attention shall be paid to insuring through ventilation in all rooms. Rooms so high that their ceilings shall be more than two feet above the top of the windows, corridors, staircases, and other open spaces shall be specially ventilated so as to prevent the accumulation of stagnant air.

6. All main drains should, where practicable, be formed outside the building. In the event of its being necessary to carry a main drain underneath a building, it must be trapped immediately outside the main wall, and a ventilating pipe must be carried from that point to the highest part of the roof, as under rule 2.—*Jour. Soc. Arts.*

Narrow Escape from Death from Illuminating Gas.

A narrow escape of five persons from suffocation by gas occurred at the residence of Mr. J. R. Chattin, at No. 107 North Greene Street, early yesterday morning. The facts of the case, as we learned them from one of the sufferers, are as follows :

After the closing of the store on Wednesday night, Mr. and Mrs. Chattin, Frank and William Devereaux, Mrs. Chattin's brothers, and a hired girl named Nettie Hughes, retired at the usual hour, and a jet of gas was left burning on the first floor. Miss Devereaux and a Miss Broome, who had gone to attend a social party on Spring Street, returned at about 2 o'clock, and after turning out the light, as Miss Devereaux believed, they retired. Instead of turning off the gas, the faucet was turned completely round, and the escaping poison filled the house in a short time. Being lighter than the atmosphere, it ascended to the sleeping apartments on the third floor and was doing its deadly work upon the occupants, until Mrs. Chattin, who was awakened by some revellers who were passing through Greene Street singing, found that her breathing was greatly oppressed, almost to suffocation, and that her room was filled with gas. She awakened her husband, and after opening the windows she hurried to the other apartments, roused the sleepers, who were similarly affected, and also opened their windows. A descent to the first floor proved that the whole house was filled with the same fluid, and the open faucet disclosed the cause of the danger. An hour or two later would have, in all probability, been too late, and instead of a fortunate escape, we would have been compelled to have added another item to the recent list of similar accidents. As it was, all those who had been affected suffered considerable difficulty in resperation, and later in the day, as that passed off, severe headaches. It is almost miraculous that the result was no worse.

Our readers cannot be too careful how they turn off their gas or in what condition they leave their stoves on retiring for the night. A moment's time spent in careful attention to these precautions may save, perhaps, a whole family from eternity.—Trenton *True American.*

SAFETY PAPER.—A bank in Lyons uses a paper which is colored with ultramarine green. The bills of exchange are lithographed, and the figures are written with an accidulated ink, so as to appear white upon a green ground. It seems to furnish perfect security against alterations.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Atmospheric Electricity and Gas Mains.

NEW HAVEN, CONN., Nov. 27, 1880.

Mr. Editor: In Van Nostrand's *Engineering Magazine* for December, current, is an article by Prof. Kirchoff, on "Lightning Rods," which is in my opinion of sufficient interest to gas companies to be worthy of transfer to your columns. The question of interest to gas people is, "Can an injury to gas pipes result from connecting them with lightning conductors?" This question, propounded to him by the City Gas Company, of Berlin, (Prussia) Prof. K. answers in the negative, with reasons assigned. But he goes on to show by instances, some of recent date, in Germany, that injury may result from the discharge of atmospheric electricity upon pipes which *are not* connected by metallic union with the lightning rods of a house, church, or other structure provided with electrical conductors. In this connection I desire to call attention to a paper presented by me at the Springfield (1859) session of the American Association for the Advancement of Science, "On the discharge of Atmospheric Electricity through Gas Mains," and published in Volume XIII. of the Proceedings (1860) p. 207. This paper describes two remarkable cases which occurred in New Haven (in June of 1858 and July of 1859). As this paper is short, and the facts appear to have escaped notice, I send you a transcript of them for publication in your Journal. Both the cases cited in my paper fall within the conditions specified by Professor Kirchoff, viz.: Cases in which the pipes were damaged by lightning because they were not connected with the lightning rod. The primary cause of the disaster, in the case of the Wooster Place Church, was the absence of any adequate ground connection for the lightning rod, which ended in dry earth protected by wide extending eaves which prevented the ground from becoming wet. In this case the street mains had been in position for some years before the erection of the church. But the small pipe in the tower named in my paper, had been introduced only a little time before the disaster. The joints of the street mains were of gasket and lead of the old style, 40 of which were opened by the discharge to an extent which permitted the escape of gas, which, when lighted, streamed up to the height of a man's head above the ground. The facts presented in my paper provoked a lively discussion among the physicists present. But no one noticed the vital point presented by Professor Kirchoff, viz., *that it was the want of a continuous metallic connection of the conductor with the gas mains which was the source of the mischief.*

This sound conclusion, as you will readily admit, has a high practical value for the consideration of gas engineers, and, we may add, for hydraulic engineers also.

Yours truly,

B. SILLIMAN.

NOTE ON THE DISCHARGE OF ATMOSPHERIC ELECTRICITY THROUGH GAS MAINS, BY B. SILLIMAN, PROFESSOR, NEW HAVEN, CONN., (taken from Volume XIII. of Proceedings of the American Association for the Advancement of Science, 1860.)

During the past year (1858) two cases have fallen under my observation of the discharge of atmospheric electricity through the iron gas mains of New Haven, with effects which, so far as I know, have not previously been noticed.

First Case.—On the last Sunday of June, 1858, about 4 P.M., a violent thunderbolt fell on the spire of the Wooster Place Baptist Church, in New Haven, and was conveyed, without injury to the spire (227 feet high) to a point less than twenty feet from the earth. At this point, owing, as was afterwards ascertained, to an imperfect ground termination of the conductor, the electrical tension was sufficient to produce a lateral disruptive discharge through a brick wall nearly twenty inches in thickness, to meet a gas pipe on the inside of the wall directly opposite to the electrical conductor. By the new channel thus forcibly gained the electric discharge was conducted to the main pipes of distribution, and no further immediate effects were seen. Within a few days, however, after the discharge, the rapid escape of gas on the street in front of the church was noticed as well by the odor as by the sickly condition and subsequent death of the shade trees lining the street. Upon opening the ground it was found to be saturated with gas, and every joint in the whole length of the street (some forty in number in a six inch pipe) was discovered to be leaking profusely.

"The inference seemed unavoidable that the leakage was occasioned by the electrical discharge.

Second Case.—During the last week in July, 1859, another very energetic discharge of atmospheric electricity fell upon a house in George street, in New Haven. This house was supplied with gas, and while but little injury was done to the dwelling, and none at all to its inhabitants, the gas mains in the whole street, to the number of sixty joints were found to be entirely loosened. They all required to be recalked.

"In both these cases the loosened joints were confined to the line of pipe in the street fronting the buildings, and the injury appeared to be arrested by the abutting pipes of the next cross street.

In June of this year the same church spire struck in 1858 was again the subject of a second accident of this sort. The wall of brick was again penetrated near the same place and in the same manner as last year, with the additional circumstance that the gas pipe in the church was fused or burnt off at the point of contact of the escaping discharge, and the gas being then set on fire, in its turn set fire to the wainscoting or furring behind which the pipe ran. But either because the volume of the discharge was less than last year, or because a portion of it found a lateral escape, there was no effect produced in disturbing the joints of the street mains.

The mechanical effects now described may be due to a sudden and almost explosive expansion of the gas in the mains at the point of electrical discharge, notwithstanding the enormous extent of the mettallic conductors. It is difficult, however, to reconcile the facts with existing views of electrical tension and discharge, and they are now brought before this Association with the hope of eliciting a satisfactory explanation of them.

The discussion excited by this paper was not reported. It engaged Profs. Henry, Bache, Loomis, Swing and others, but the solution now offered by Kirchoff was not suggested.

Professor Kirchoff's paper in the *Deutsche Banzeitung* is given in abstract by "Van Nostrand's Engineering Magazine," December, 1880, pp. 471.

Anent the "Stoppage" Question.

Mr. Editor: If I interpret correctly the report of the discussion of this question occurring at the late meeting of the Association at Chicago, it is Mr. Forstall's theory that "stoppage" is the result of temperature only, *i. e.*, if favorable conditions of temperature are established between mouthpiece and dip pipes that accumulation of dry carbon or sluggish pitch will not occur, let the heat of the retort be at its maximum, and the character of the coal what it may. The conditions he seems to favor are a hot stand pipe and a relatively cooler mouthpiece. The correctness of this idea can only be determined by experiment. My own experience here is that, given a hot stand pipe of any diameter from four inches to seven, with a column of the products of carbonization from an intensely heated retort ascending through it, and you have the conditions necessary to have stoppage in its most pronounced form, especially if the interior of the stand pipe, or parts of it, are rough and uneven, and if the coal used contains an unctuous quality of bitumen.

The fact is, the intense heat of the ascending gas, supplemented by that radiating from the oven, is communicated to the stand pipe and thereby makes it a retort, and the "charge" consists of the undecomposed material carried away from the retort by the ascending gas, and it is only a question of time till this accumulated charge must be withdrawn. By reversing this process, and maintaining a cool stand pipe, with or without a hot mouthpiece so long as the mixed substances ascending are of a certain character, accumulation cannot occur nor stoppage result. If these substances contain a sticky, plastic pitch, neither cooling nor heating the stand pipe will afford relief, because cooling this pitch keeps it in a condition too thick to ascend with the gas, and likewise causes it to move so slowly downward that it soon fills up the pipe; and, on the other hand heating it drives out all of the lighter oils and bakes it hard. The remedy, therefore, is not alone in temperature but in changing the character of this bitumen so that, by cooling the stand pipe, it is kept in a fluid condition, and will run down readily into the mouthpiece. It is possible that this end can be accomplished by the admission of moisture alone at a specified point, but with some coals that I have used I doubt it. The matter has been accomplished here and elsewhere by the addition of from ten to fifteen per cent. of coal of a different character from the rich bituminous coals, mixing it so that each retort gets the right proportion when charged, and, when retorts are highly heated, keeping, the stand pipe cool. When I speak of highly heated retorts I mean such heat as will carbonize the maximum charge in from three hours to three hours and a-half. I find that in using Scott's "Ocean Mine" coal with such a heat, that I can stop my stand pipes promply at the first or second charge with either hot or cold stand pipes; and that by modifying slightly the character of this excellent coal, by the admixture of a small percentage of coal almost destitute of bitumen, and keeping the stand pipes cool, that the difficulty immediately and permanently vanishes.

Yours respectfully,

D. R. SHIRAS.

Something Astonishing.

PHILADELPHIA, PA., November 19th, 1880.

Mr. Editor: I enclose to you a slip from the Washington *Evening Star*. When gas consumers admit that they have done a gas company an injustice, and voluntarily make restitution, the Millennium must be near at hand.

"Our city gas company received an anonymous note to day inclosing one dollar, and stating that it belonged to the gas company. The company has several times during the past few years received sums of money which the senders state have been wrongfully obtained." X.

THE AMERICAN GAS-LIGHT JOURNAL AND CHEMICAL REPERTORY

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THURSDAY, DEC. 2, 1880.

Official Report of Examinations of Gas for two Weeks ending Nov. 27, 1880, made at the Photometrical Room of the Department of Public Works.

Corrected Illuminating Power.

1880. Nov.	Time of Day at which Test were made.	New York Gas Light Co.	Manhattan Gas-Light Co.	Mutual Gas-Light Co.	Metropolitan Gas-Light Co.	Harlem Gas-Light Co.	Municipal Gas-Light Co.
		†	*	†	‡	*	†
15	Between 9.30 A.M. and 1 P.M.	25.17	18.36	24.58	22.78	18.06	25.94
16		21.31	18.39	25.60	22.83	18.60	24.02
17		20.56	18.24	25.75	23.96	18.56	24.61
18		20.50	18.06	26.03	23.16	19.74	26.46
19		26.28	18.14	25.15	22.83	19.10	26.16
20		22.06	17.75	25.04	22.74	19.32	25.84
	Average	22.64	18.16	25.36	23.06	18.89	25.50
22		18.49	17.32	23.62	22.06	18.59	27.28
23		19 84	——	20.96	21.94	18.47	25.16
24		23.25	18.39	23.67	21.72	18.38	27.47
26		24.11	19.00	23.56	22.07	18.92	24.39
27		23.28	19.78	23.02	22.84	19.10	25.43
	Average	21.79	18.62	22.96	22.12	18.69	25.94

* Five foot lava tip with check.
† Bray's slit union, No. 7.
‡ Bray's slit union, No. 6.

E. G. LOVE, Gas Examiner.

Cane Presentation.

The employees of the Allegheny Gas Company last night presented the retiring foreman, Mr. Isaac Baxter, with a handsome gold-headed cane and a beautiful diamond pin with a set of studs to match. Mr. Baxter was lured from his home, where he was seated at the supper table, by the information that a big fight was in progress at the works. He at once hastened there, and arriving there out of breath was seized by the good-natured crowd and informed that he was the the object of their wrath, and Patrick Peyton forthwith proceeded to administer an eloquent caneing, which Mr. Baxter took in very good humor. A good time generally was had, and the retiring foreman cannot help feeling flattered at the mark of appreciation bestowed upon him by workmen in the Company's employ. Mr. Baxter leaves on Monday for Washington, where he accepts a similar position in the gas works of that city.—Pittsburgh *Times*, Nov. 13.

Cheap Gas.

According to the London *Echo*, a remarkable invention has just been patented in France. For many years inventors have been tying to devise a means of utilizing water gas, but certain "finality prophets" pointed out that, as it cost as much to dissociate the gases forming water as they were worth as fuel when separated, the research was much like seeking for perpetual motion. If report speaks truly, however, the problem has been solved by M. Paul Aube, who at one operation converts iron into steel and produces an illuminating gas. By a combination of the two processes he carbonizes the iron, and, at the same time obtains carburetted hydrogen, or the equivalent of coal gas, at a merely nominal cost. The iron is placed in a retort with charcoal or coke, and, being raised to the proper temperature, is supplied with a dose of fatty matter, and subsequently, when steam is introduced, the latter is immediately decomposed, the oxygen uniting with the coke and the hydrogen combining with the vapor of carbon, thus converting the iron into steel, and producing an illuminating gas at one operation. The cost of the process is more than covered by the difference in value of iron and steel, and the "gas" consequently represents only a portion of the clear profits.

Our Exchanges.

[From the "Sanitary Engineer."

At Wheeling, W. V., the price of gas has been reduced, and the effect is seen in a largely increased consumption. This has necessitated an additional holder of 200,000 cubic feet, and an increase in the producing capacity.

An English judge has decided that a tenant is not responsible for the unpaid gas bill of a former tenant, "unless such incoming tenant has undertaken with the former tenant to pay and release him from the payment of such arrears."

The City of Exeter Gas Company, England, recently offered four medals for gas heating and gas cooking apparatus, exhibited at the sanitary exhibition held in that city under the auspices of the Sanitary Institute of Great Britain. The judges of the exhibition were appointed to award these medals, and a series of elaborate experiments were carried out with the various apparatus. The awards will be published shortly.

Among the matters which came before the Midland Gas Managers at Birmingham, England, lately, was the question of meter rents. Mr. Woodall read a paper in which he argued that meter rents were necessary in the case of small consumers. Mr. Hunt said the arguments brought forward were in favor of a differential price of gas, rather than the retention of the meter. Meter charges had been abolished in Birmingham. The discussion was in favor of the gradual abolition of meter rents.

Engineering, speaking of the lighting of the Royal Albert Dock by Siemens Bros., says it is "the most extensive installation in the world of the electric light." The space, 6,500 feet long and 490 feet wide, is lighted by 27 of the Siemens pendulum lamps, placed on iron poles 80 feet high, the "effective illuminating area of each lamp overlapping those of its consecutive neighbors." The lamps have the regulating apparatus above the arc, and over each there is a "slightly convex reflector of enamelled iron, which distributes the light very uniformly, giving at the same time apparent magnitude to its source."

The Detroit *Free Press*, in speaking of the benefit derived by children suffering from whooping cough from frequent visits to the purifying house of a gas works, says: "The children are sent there usually by the direction of the family doctor to inhale the ammonia which arises from the purifying boxes." As a matter of fact, it is not ammonia that does the business, or they might inhale it at home, but certain substances found in coal tar called phenol or carbolic acid and cresol. Cresol is closly related to carbolic acid, and is sold for use in cases of throat difficulties under the name of creosolene. It may be vaporized in the patient's room, and he has all the virtues of the purifying house with none of its unpleasant features.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.
DECEMBER 2, 1880.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	*Par.*	*Bid.*	*Asked*
Gas Co.'s of N. Y. City.				
Central	466,000	50	60	70
Harlem	1,800,000	50	70	73
" Bonds	170,000			103
Manhattan	4,000,000	50	177	182
Metropolitan	2,500,000	100	135	140
" Scrip	$1,000,000	...	102	105
Mutual	5,000,000	100	70	75
" Bonds, gold	900,000	1000	100	104
Municipal	1,500,000	100	170	175
" Bonds	750,000		106	110
New York	4,000,000	100	102	104
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	112	115
Citizens	1,200,000	20	60	65
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	70	80
Peoples	1,000,000	10	28	33
" Bonds.	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan	1,000,000	100	60	63
Nassau	1,000,000	25	47	52
" Ctfs.	700,000	1000	85	95
Williamsburgh	1,000,000	50	60	65
" Bonds		...	98	103
Kings Co	135,000	100	60	70
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	75	80
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	75	80
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	10[illegible]	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Consolidated, Balt.			84	85
Bonds			[illegible]09	110
East Boston, Mass		25	114	120

Hannibal, Mo.....	100,000	100	95	100
Hartford, Conn.....	700,000	25	140	144
Hempstead, L. I.....	25,000	100	...	—
Halifax N. S.....	400,000	40	148	150
Hamilton, Ontario...	150.000	40	117½	
Jersey City	750,000	20	150	160
Jacksonville, Ill.....	120,000	50	100	...
Lewistown Maine...	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	108	110
Montreal, Canada....	2,000,000	100	148	149
New Haven, Conn...		25	140	150
Oakland, Cal.....			35	36
Peoples, Jersey City		...	85	90
" " Bds.				5
Pittsfield, Mass.....			120	130
Rochester, N. Y.....		50	70	80
" Citizens		100	30	35
Rondout & Kingston			75	80
St. Louis Missouri..	600 000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			73	74
Toledo, Ohio..... . .			95	97
Troy, Citizens.....	600,000	100	—	—
Washington, D. C...	1,500,000	20	215	225
" Scrip	500,000	20	125	—
Woonsocket, R. I....	150,000	100	80	...
Wilmington, Del....		50	174	...
Yonkers.....		50	—	70

The Brooklyn Gas Light Company have declared a dividend of five per cent. payable on and after Nov. 30

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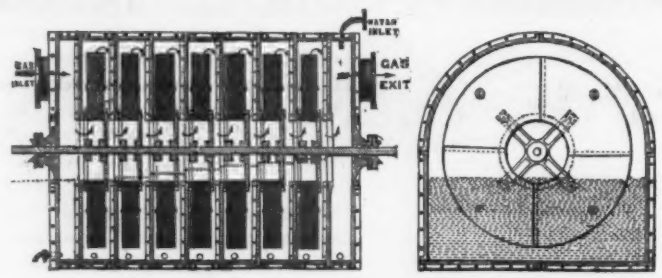

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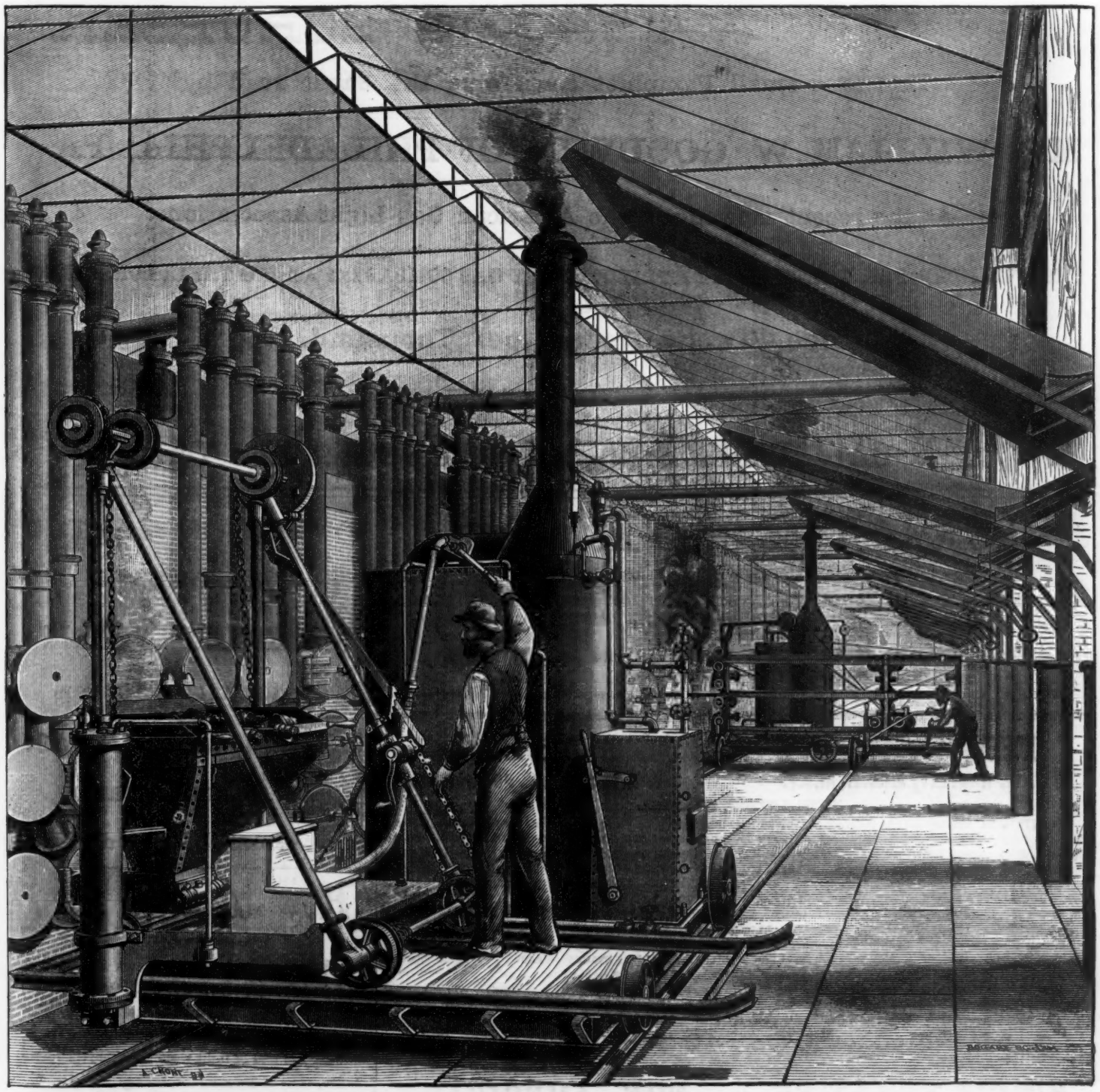

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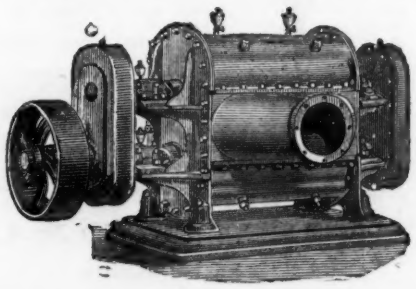

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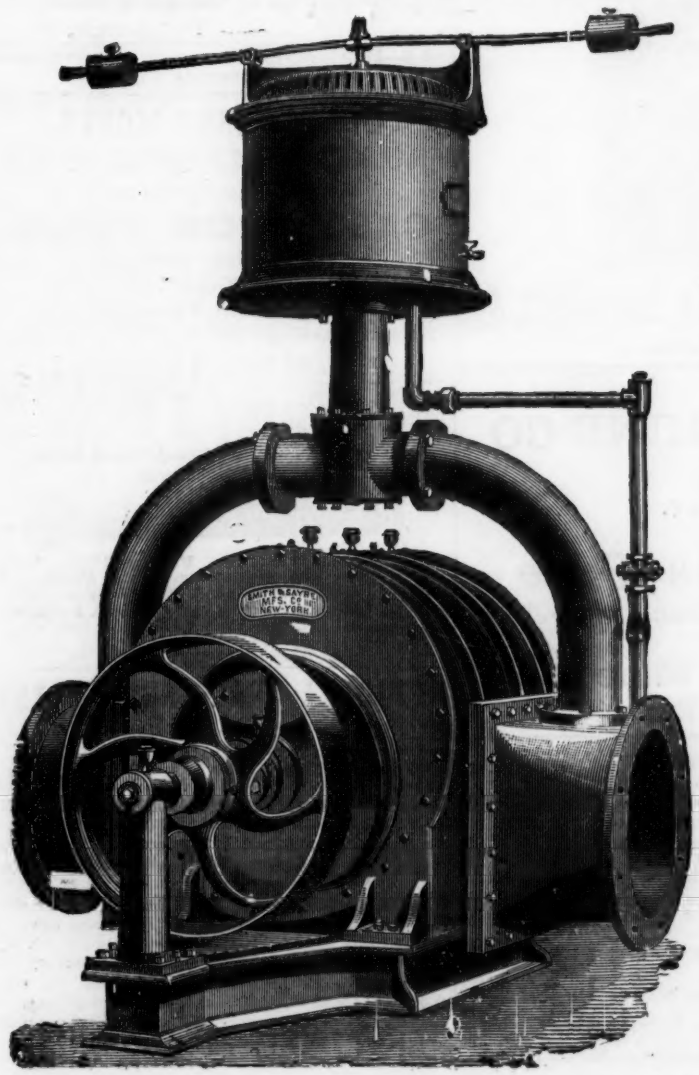

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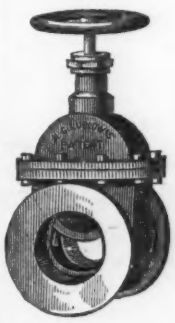

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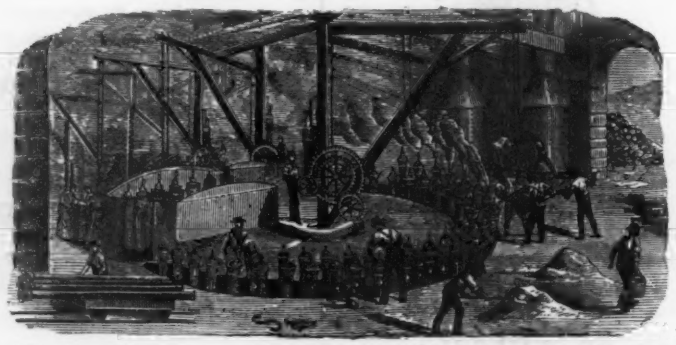

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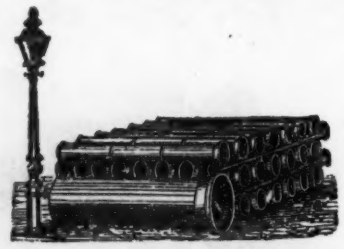

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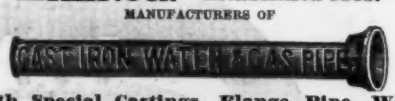

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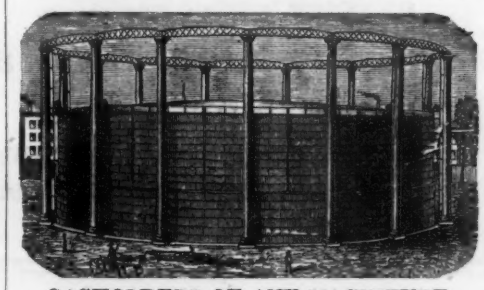

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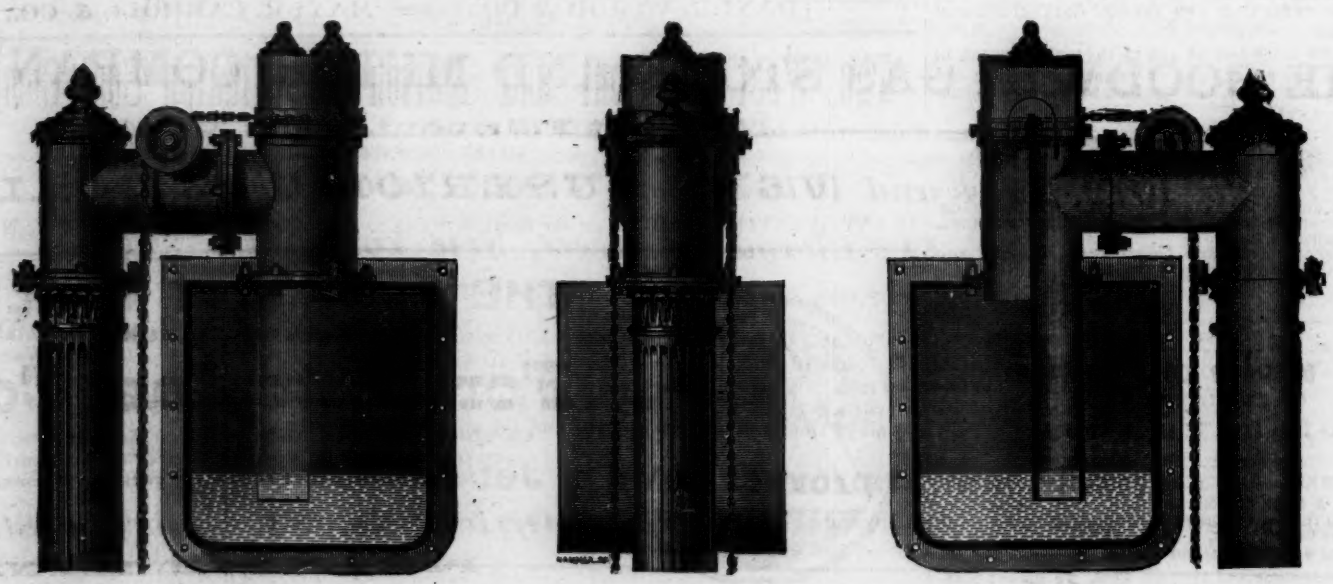

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